PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Denis Proulx, et al.

Title: METHOD AND SYSTEM FOR IP LINK MANAGEMENT

App. No.: 10/027,821 Filed: 12-19-2001

Examiner: Ke, Peng Group Art Unit: 2174

Atty. Docket No.: 1400.1374890

Mail Stop Appeal Brief - Patents
Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

Dear Sir:

In response to the Notice of Appeal filed September 18, 2009, Appellant submits the following:

STATEMENT OF REAL PARTY IN INTEREST

As presently advised, Alcatel-Lucent Canada Inc. is the real party in interest in this appeal by virtue of an executed Assignment of the entire interest from the named Inventor(s), Denis Proulx, Chuong Ngoc Ngo, Attaullah Zabihi, David Wing-Chung Chan and Felix Katz, to Alcatel Canada Inc., recorded in the United States Patent and Trademark Office on 05-09-2002 at Reel 012876, Frame 0474, followed by a Certificate of Amalgamation from Alcatel Canada Inc. to Alcatel-Lucent Canada Inc. dated January 1, 2007. Appellant encloses copies of the above-referenced Assignment and Certificate of Amalgamation.

STATEMENT OF RELATED CASES

As presently advised, there are no other prior or pending appeals, interferences, or judicial proceedings known to Appellant, the Appellant's legal representative, or Assignee which may be related to, directly affect, or be directly affected by, or have a bearing on the Board's decision in the pending appeal.

JURISDICTIONAL STATEMENT

This appeal is taken under 35 U.S.C. § 134. A final Office action rejecting claims 1-18 has a mail date of March 18, 2009. A notice of appeal and a petition for extension of time were received at the United States Patent and Trademark Office on September 24, 2009. This appeal brief and a petition for extension of time are being mailed April 26, 2010.

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STATUS OF AMENDMENTS

Appellant has not amended the specification, drawings, or claims subsequent to final rejection.

GROUNDS OF REJECTION TO BE REVIEWED

The grounds of rejection to be reviewed on appeal are as follow:

Claim Rejections - 35 *USC* § *102*

Claims 1-4, and 7-18 are rejected under 35 U.S.C. 102(b) as being anticipated by Hansen US Patent 5,838,907.

Claim Rejections - 35 *USC* § *103*

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hansen in view of Hansen US Patent 5,838,907 [sic] in view of Hardwick US Patent 5,550,816.

Claims 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hansen in view of Hansen US Patent 5,838,907 [sic] in view of Chui US Patent 2002/0165978.

STATEMENT OF FACTS

F1. As an example, Appellant submits the cited portions of the cited reference fail to disclose "determining local interface and next neighbor information for the network device." Office action response 11/20/2008, p. 6, l. 7-9.

F2. The Examiner cites "(figure 7, items 114, 116, 120, 126, 122, 118, and 124)" of the Hansen reference as allegedly disclosing such feature. Office action response 11/20/2008, p. 6, l. 9-10.

F3. Appellant notes Figure 7 of the Hansen reference merely purports to be an illustration of a configuration manager GUI, but does not appear to disclose any method steps. Office action response 11/20/2008, p. 6, l. 10-12; Hansen, Fig. 7.

F4. As another example, Appellant submits the cited portions of the cited reference fail to disclose "determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database." Office action response 11/20/2008, p. 6, l. 13-15.

F5. The Examiner cites "(column 5, lines 35-64; Subsystem is a logical link database)." Office action response 11/20/2008, p. 6, l. 16.

F6. Appellant notes the cited portion of the cited reference states, "The data and programming instruction are stored in the memory subsystem 6...." Office action response 11/20/2008, p. 6, l. 16-18; Hansen, col. 5, lines 35-64.

F7. Appellant sees no teaching as to "determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality

of logical configuration links in a logical link database." Office action response 11/20/2008, p. 6, l. 18-20.

F8. As yet another example, Appellant submits the cited portions of the cited reference fail to disclose "creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database." Office action response 11/20/2008, p. 6, l. 21-23.

F9. The Examiner cites "(column 15, lines 30-50; Unconnected PCI slot are unassociated connection). Office action response 11/20/2008, p. 6, l. 24-25.

F10. Appellant notes col. 15, lines 33-39, state, "As may now be seen, the various network entities, as well as unconnected connection interfaces, are graphically displayed on the backplane bitmap 220 using information contained in the bitmap section 36 of the configuration script 12-N and the local configuration file 20 for the Compaq router 122." Office action response 11/20/2008, p. 6, l. 25-28; Hansen, col. 15, lines 33-39.

F11. The Examiner cited col. 5, lines 49-52, in alleging "Subsystem is a logical link database." Office action response 11/20/2008, p. 6, l. 28-29.

F12. Appellant submits col. 5, lines 49-52, states "If a particular network device does not have a configuration script, a configuration file cannot be constructed by the network device configuration tool 10." Office action response 11/20/2008, p. 6, l. 29, to p. 7, l. 2; Hansen, col. 5, lines 49-52.

F13. Appellant submits the Examiner's apparent interpretation of the teachings of the prior art would appear to render them inoperable. Office action response 11/20/2008, p. 7, l. 2-3.

F14. As yet another example, Appellant submits the cited portions of the cited reference fail to disclose "storing the new logical configuration link in the logical link database." Office action response 11/20/2008, p. 7, l. 5-6.

F15. The Examiner cites "(column 13, lines 10-30)." Office action response 11/20/2008, p. 7, l. 6-7.

F16. Appellant submits col. 13, lines 22-26, state, "If either the origination or destination device or entity do not have an available slot which is connectable to the other device or entity, a determination is made at step 156 that the devices/entities cannot be connected." Office action response 11/20/2008, p. 7, l. 7-9; Hansen, col. 13, lines 22-26.

F17. Appellant submits the cited portion of the cited reference fails to disclose "storing the new logical configuration link in the logical link database." Office action response 11/20/2008, p. 7, l. 9-11.

F18. As a further example, Appellant submits the cited portions of the cited reference fail to disclose "sending the new logical configuration link to the network device." Office action response 11/20/2008, p. 7, l. 12-13.

F19. The Examiner cites "(column 14, lines 41-60)." Office action response 11/20/2008, p. 7, l. 13-14.

F20. Appellant notes col. 14, lines 48-50, states "...before saving the constructed local configuration file 20 to the memory subsystem and associating it with the device." Office action response 11/20/2008, p. 7, l. 14-15; Hansen, col. 14, lines 48-50.

F21. Appellant submits the cited portion of the cited reference does not appear to disclose "sending the new logical configuration link to the network device." Office action response 11/20/2008, p. 7, l. 16-17.

F22. Regarding claim 2, Appellant submits the cited portions of the cited reference fail to disclose "selecting a link type." Office action response 11/20/2008, p. 7, l. 19-20.

F23. The Examiner cites "(column 13, lines 1-10; x.25, frame relay, PPP and HDLC are link types." Office action response 11/20/2008, p. 7, l. 20-21.

F24. Appellant submits the Examiner has alleged, with respect to claim 1, from which claim 2 depends, that "Subsystem is a logical link database." Office action response 11/20/2008, p. 7, l. 21-22; final Office action 3/18/2009, p. 2, l. 22.

F25. Appellant submits the Examiner doesn't provide any evidence that "Subsystem" includes any information pertaining to "frame relay, PPP and HDLC." Office action response 11/20/2008, p. 7, l. 22-24.

F26. Appellant submits the Examiner's apparent interpretation of the teachings of the prior art would appear to render them inoperable. Office action response 11/20/2008, p. 7, l. 24-25.

F27. Appellant submits the cited portions of the cited reference fail to disclose "selecting a link numbering type for the new logical configuration link." Office action response 11/20/2008, p. 7, l. 26-27.

F28. The Examiner alleges "(column 11, lines 13-30; PCI slots are numbered configuration links)." Office action response 11/20/2008, p. 7, l. 27-28.

F29. Appellant submits such allegation does not disclose a step of "selecting a link numbering type...." Office action response 11/20/2008, p. 7, l. 28-29.

F30. As a further example, Appellant submits the cited portions of the cited reference fail to disclose "selecting a link application for the new logical configuration link." Office action response 11/20/2008, p. 8, l. 1-2.

F31. The Examiner alleges "(column 14, lines 5-25; The script commands are applications; column 13, lines 65-column 14, lines 5)." Office action response 11/20/2008, p. 8, l. 2-4; final Office action 3/18/2009, p. 3, l. 18.

F32. Appellant notes the Examiner alleged with respect to "creating a new logical configuration link..." of claim 1, from which claim 2 depends, "Unconnected PCI slot are unassociated connection." Office action response 11/20/2008, p. 8, l. 4-5; final Office action 3/18/2009, p. 3, l. 3.

F33. Appellant sees no allegation by the Examiner that "the script commands" disclose link applications for "unconnected PCI slot." Office action response 11/20/2008, p. 8, l. 6-7.

F34. The Examiner appears to allege "unconnected PCI slot" discloses "the new logical configuration link." Office action response 11/20/2008, p. 8, l. 7-8; final Office action 3/18/2009 p. 3, l. 1-3.

F35. Appellant submits the Examiner's allegations appear to be inconsistent and would render the purported teachings of the cited reference inoperable. Office action response 11/20/2008, p. 8, l. 8-10.

F36. As yet another example, Appellant submits the cited portions of the cited reference fail to disclose "selecting a sub layer interface type for the new logical configuration link." Office action response 11/20/2008, p. 8, l. 11-12.

F37. The Examiner cites "(column 14, lines 15-25; Connection identifiers are configuration links)." Office action response 11/20/2008, p. 8, l. 13; final Office action 3/18/2009, p. 3, l. 19-20.

F38. Appellant notes the Examiner alleged, with respect to "creating a new logical configuration link" of claim 1, from which claim 2 depends, "Unconnected PCI slot are unassociated connection." Office action response 11/20/2008, p. 8, l. 13-15; final Office action 3/18/2009, p. 3, l. 1-3.

F39. Appellant submits "connection identifiers are configuration links" is inconsistent with the purported teachings alleged by the Examiner with respect to claim 1, thereby apparently rendering such teachings inoperable. Office action response 11/20/2008, p. 8, l. 15-17.

F40. Appellant submits "connection identifiers are configuration links" fails to disclose "selecting a sub layer interface type...." Office action response 11/20/2008, p. 8, l. 18-19.

F41. As yet another example, Appellant submits the cited portions of the cited reference fail to disclose "creating a first endpoint for the new logical configuration link" and "creating a second endpoint for the new logical configuration link." Office action response 11/20/2008, p. 8, l. 20-22.

F42. The Examiner cites "(column 13, lines 10-30)." Office action response 11/20/2008, p. 8, l. 22; final Office action 3/18/2009, p. 4, l. 1-2.

F43. Appellant submits col. 13, lines 22-26, states, "If either the origination or destination device or entity do not have an available slot which is connectable to the other device or entity, a determination is made at step 156 that the devices/entities cannot be connected." Office action response 11/20/2008, p. 8, l. 23-25; Hansen, col. 13, lines 22-26.

F44. Appellant submits the cited portion of the cited reference fails to disclose "creating a first endpoint for the new logical configuration link." Office action response 11/20/2008, p. 8, l. 25-26.

F45. Appellant submits the cited portion of the cited reference fails to disclose "creating a second endpoint for the new logical configuration link." Office action response 11/20/2008, p. 8, l. 25-27.

F46. Regarding claim 3, Appellant submits the cited portion of the cited reference fails to disclose "selecting the link type from among a group consisting of: point-to-point, point-to-IP, and point-to-subnet." Office action response 11/20/2008, p. 8, l. 29-30.

F47. The Examiner cites "(column 13, lines 1-10; x.25, frame relay, PPP and HDLC)." Office action response 11/20/2008, p. 8, l. 30, to p. 9, l. 1; final Office action 3/18/2009, p. 4, l. 6.

F48. Appellant notes the inconsistency Appellant alleges with respect to the Examiner's allegations regarding "selecting a link type" in claim 2, from which claim 3 depends. Office action response 11/20/2008, p. 9, l. 1-3.

F49. Appellant submits the Examiner's allegations with respect to claim 3 also render the Examiner's apparent interpretation of the purported teachings of the cited portions of the cited reference inoperable. Office action response 11/20/2008, p. 9, l. 3-5.

F50. Regarding claim 4, Appellant submits the cited portions of the cited reference fail to disclose "selecting the link numbering type from a group consisting of: a numbered type and an unnumbered type." Office action response 11/20/2008, p. 9, l. 7-9.

F51. The Examiner cites "column 11, lines 13-30; PCI slots are numbering type, column 13, lines 28-45; a list of connection interface is un-number type)." Office action response 11/20/2008, p. 9, l. 9-10; final Office action 3/18/2009, p. 4, l. 10-11.

F52. Appellant notes the inconsistency Appellant alleges with respect to the Examiner's allegations regarding "selecting a link numbering type..." in claim 2. Office action response 11/20/2008, p. 9, l. 10-12.

F53. Appellant submits the Examiner's allegations with respect to claim 4 also render the Examiner's apparent interpretation of the purported teachings of the cited portions of the cited reference inoperable. Office action response 11/20/2008, p. 9, l. 12-14.

F54. Regarding claim 7, Appellant submits the cited portions of the cited reference fail to disclose "modifying a logical configuration link in the logical link database." Office action response 11/20/2008, p. 9, l. 16-17.

F55. The Examiner cites "(column 11, lines 41-53; Editing is modifying)." Office action response 11/20/2008, p. 9, l. 17-18; final Office action 3/18/2009, p. 4, l. 13-14.

F56. The Examiner alleged "Unconnected PCI are unassociated connection" as purportedly teaching "creating a new logical configuration link..." in claim 1. Office action response 11/20/2008, p. 9, l. 18-20; final Office action 3/18/2009, p. 3, l. 1-3.

F57. Appellant sees no reference to such "unconnected PCI" in "(column 11, lines 41-53; Editing is modifying)," as alleged by the Examiner. Office action response 11/20/2008, p. 9, l. 21.

F58. Regarding claim 8, Appellant submits the cited portions of the cited reference fail to disclose "deleting a logical configuration link in the logical link database." Office action response 11/20/2008, p. 9, l. 24-25.

F59. The Examiner cites "(column 10, lines 1-20)." Office action response 11/20/2008, p. 9, l. 25-26; final Office action 3/18/2009, p. 4, l. 16.

F60. Appellant notes the Examiner alleged "Unconnected PCI are unassociated connection" as purportedly teaching "creating a new logical configuration link..." in claim 1. Office action response 11/20/2008, p. 9, l. 26-27; final Office action 3/18/2009, p. 3, l. 1-3.

F61. Appellant sees no reference to such "unconnected PCI" in "(column 10, lines 1-20)," as alleged by the Examiner. Office action response 11/20/2008, p. 9, l. 28-29.

F62. Appellant submits teachings in "(column 10, lines 1-20)" appear to be inconsistent with "unconnected PCI." Office action response 11/20/2008, p. 9, l. 29-30.

F63. For example, "telnet to this device," "view ip addresses," and "view ipx addresses" appear to be inconsistent with "unconnected PCI," as cited by the Examiner with respect to claim 1. Office action response 11/20/2008, p. 9, l. 30, to p. 10, l. 2; Hansen, column 10, lines 1-20.

F64. Regarding claim 9, Appellant notes the Examiner states "As per claim 9, it is of the same scope as claim 1. Supra." Office action response 11/20/2008, p. 10, l. 5-6; final Office action 3/18/2009, p. 4, l. 17.

F65. Appellant respectfully disagrees and notes claim 9 is directed to different subject matter than claim 1. Office action response 11/20/2008, p. 10, l. 6-7.

F66. Regarding claim 11, Appellant submits the cited portions of the cited reference fail to disclose "wherein the processing system determines local interface and next neighbor information for the network device." Office action response 11/20/2008, p. 10, l. 13-15.

F67. The Examiner cites "(figure 7, items 114, 116, 120, 126, 122, 118, and 124)." Office action response 11/20/2008, p. 10, l. 15; final Office action 3/18/2009, p. 5, l. 5.

F68. Appellant submits Figure 7 of the Hansen reference merely purports to be an illustration of a configuration manager GUI, but does not appear to disclose "wherein the processing system determines local interface and next neighbor information for the network device." Office action response 11/20/2008, p. 10, l. 16-18; Hansen, Fig. 7.

F69. Regarding claim 12, Appellant submits the cited portions of the cited reference fail to disclose "wherein the processing system determines whether the local interface and next neighbor information is associated with one of the logical configuration links stored in the logical link database." Office action response 11/20/2008, p. 10, l. 20-22.

F70. The Examiner cites "(column 15, lines 30-50; Unconnected PCI slot are unassociated connection)." Office action response 11/20/2008, p. 10, l. 22-23; final Office action 3/18/2009, p. 5, l. 8-9.

F71. Appellant submits the "Unconnected PCI slot are unassociated connection" alleged by the Examiner fails to disclose, for example, "next neighbor information" and "the logical link database." Office action response 11/20/2008, p. 10, l. 24-25.

F72. Regarding claim 13, Appellant submits the cited portions of the cited reference fail to disclose "wherein the processing system creates a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links stored in the logical link database." Office action response 11/20/2008, p. 11, l. 1-4.

F73. The Examiner cites "(column 13, lines 10-30)." Office action response 11/20/2008, p. 11, l. 4; final Office action 3/18/2009, p. 4, l. 13.

F74. Appellant submits col. 13, lines 22-26, state, "If either the origination or destination device or entity do not have an available slot which is connectable to the other device or entity, a determination is made at step 156 that the devices/entities cannot be connected." Office action response 11/20/2008, p. 11, l. 4-7.

F75. Appellant submits the cited portion of the cited reference fails to disclose "wherein the processing system creates a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links stored in the logical link database." Office action response 11/20/2008, p. 11, l. 7-10.

F76. Regarding claim 14, Appellant submits the cited portions of the cited reference fail to disclose "wherein the processing system causes the new logical configuration link to be stored in the logical link database." Office action response 11/20/2008, p. 11, l. 12-14.

F77. The Examiner cites "(column 13, lines 10-30)." Office action response 11/20/2008, p. 11, l. 14; final Office action 3/18/2009, p. 5, l. 16.

F78. Appellant submits col. 13, lines 22-26, state, "If either the origination or destination device or entity do not have an available slot which is connectable to the other device or entity, a determination is made at step 156 that the devices/entities cannot be connected." Office action response 11/20/2008, p. 11, l. 14-17; Hansen, col. 13, lines 22-26.

F79. Appellant submits the cited portion of the cited reference fails to disclose "wherein the processing system causes the new logical configuration link to be stored in the logical link database." Office action response 11/20/2008, p. 11, l. 17-19.

F80. Regarding claim 16, Appellant submits the cited portions of the cited reference fail to disclose "wherein the processing system causes the new logical configuration link to be sent to the network device." Office action response 11/20/2008, p. 11, l. 23-25.

F81. The Examiner cites "(column 14, lines 41-60)." Office action response 11/20/2008, p. 11, l. 25; final Office action 3/18/2009, p. 5, l. 21.

F82. Appellant notes col. 14, lines 48-50, states "...before saving the constructed local configuration file 20 to the memory subsystem and associating it with the device." Office action response 11/20/2008, p. 11, l. 25-27; Hansen, col. 14, lines 48-50.

F83. Appellant submits the cited portion of the cited reference does not appear to disclose "wherein the processing system causes the new logical configuration link to be sent to the network device." Office action response 11/20/2008, p. 11, l. 27-29.

F84. Regarding claim 17, Appellant submits the cited portions of the cited reference fail to disclose "wherein creating the new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database occurs based on interfaces information entered by a user." Office action response 11/20/2008, p. 12, l. 1-4.

F85. The Examiner states "As per claim 17, it is rejected under the same rationale as claim 1. Supra." Office action response 11/20/2008, p. 12, l. 4-5; final Office action 3/18/2009, p. 6, l. 1.

F86. Appellant notes claim 17 is directed to different subject matter than claim 1. Office action response 11/20/2008, p. 12, l. 5-6.

F87. Regarding claim 18, Appellant submits the cited portions of the cited reference fail to disclose the subject matter recited in claim 18. Office action response 11/20/2008, p. 12, l. 10-11.

F88. Appellant notes the Examiner states "As per claim 18, it is rejected under the same rationale as claim 2." Office action response 11/20/2008, p. 12, l. 11-12; final Office action 3/18/2009, p. 6, l. 2.

F89. Appellant notes claim 18 is directed to different subject matter than claim 2. Office action response 11/20/2008, p. 12, l. 12-13.

F90. Nonetheless, Appellant submits the Examiner has not alleged anticipation with respect to subject matter recited in claim 18. Office action response 11/20/2008, p. 12, l. 16-17.

F91. As one example, Appellant submits claim 18 recites "populating form panels with the link type, the link numbering type, the link application, and the sub layer interface type." Office action response 11/20/2008, p. 12, l. 17-18.

F92. Claim 2 does not. Office action response 11/20/2008, p. 12, 18-19.

F93. As another example, Appellant submits claim 18 recites "receiving user input of interfaces information." Office action response 11/20/2008, p. 12, l. 19-20.

F94. As yet another example, Appellant submits claim 18 recites "validating the interfaces information." Office action response 11/20/2008, p. 12, l. 20-21.

F95. As a further example, Appellant submits claim 18 recites "creating a link in accordance with the interfaces information." Office action response 11/20/2008, p. 12, l. 21-22.

F96. As another example, Appellant submits claim 18 recites "provisioning the link." Office action response 11/20/2008, p. 12, l. 22-23.

F97. Appellant submits the Examiner has not alleged any teaching as to such subject matter. Office action response 11/20/2008, p. 12, l. 23-24.

F98. As an example, Appellant submits the cited portions of the cited reference fail to disclose or suggest "selecting the link application from a group consisting of: Internet Protocol Forwarding, Multi-Protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching." Office action response 11/20/2008, p. 13, l. 2-5.

F99. Appellant notes the Examiner alleges, with respect to claim 2, "The script commands are applications." Office action response 11/20/2008, p. 13, l. 5-6; final Office action 3/18/2009, p. 3, l. 18.

F100. The Examiner alleges "Hardwick teaches the step of selecting a link application from a group consisting of: Internet Protocol Forwarding, Multi-Protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching (column 43, lines 60-column 44, lines 5)." Office action response 11/20/2008, p. 13, l. 6-9; final Office action 3/18/2009, p. 6, l. 17-19.

F101. Appellant submits the Examiner's allegations as to purported teachings of the cited references with respect to the subject matter of claims 2 and 5 are inconsistent and contradictory, thereby rendering the supposed combination of the purported teachings inoperable. Office action response 11/20/2008, p. 13, l. 9-12.

F102. Appellant submits the Examiner's alleged motivation to combine the references does not appear to pertain to the supposed combination of the purported teachings. Office action response 11/20/2008, p. 13, l. 12-14.

F103. As an example, Appellant submits the cited portions of the cited reference fail to disclose or suggest "selecting the sub layer interface type from a group consisting of: Packet Over Sonet, Asynchronous Transfer Mode, and GigEthernet." Office action response 11/20/2008, p. 13, l. 21-23.

F104. Appellant notes the Examiner alleges, with respect to claim 2, from which claim 6 depends, "Connection identifiers are configuration links." Office action response 11/20/2008, p. 13, l. 23-25; final Office action 3/18/2009, p. 3, l. 20.

F105. The Examiner alleges "Chui teaches selecting a sub layer interface type comprises the step of: Selecting the sub-layer interface type from a group consisting of: Packet over Sonet, Asynchronous Transfer Mode, and GigEthernet." Office action response 11/20/2008, p. 13, l. 25-27; final Office action, p. 7, l. 7-9.

F106. Appellant submits the Examiner's allegations as to purported teachings of the cited references with respect to the subject matter of claims 2 and 6 are inconsistent and contradictory, thereby rendering the supposed combination of the purported teachings inoperable. Office action response 11/20/2008, p. 13, l. 27-30.

F107. Appellant submits the Examiner's alleged motivation to combine the references does not appear to pertain to the supposed combination of the purported teachings. Office action response 11/20/2008, p. 13, l. 30, to p. 14, l. 2.

ARGUMENT

Rejection of Claims 1-4 and 7-18 under 35 U.S.C. 102(b) as being anticipated by Hansen US Patent 5,838,907

Appellant submits there exist clear errors in the Examiner's rejections and/or the Examiner's omissions of one or more essential elements needed for a prima facie rejection. Appellant submits the Examiner's "Response to Arguments" provides evidence that the Examiner has failed to consider the pending claims as required by the Manual of Patent Examining Procedure (MPEP) and prevailing case law. For anticipation under 35 U.S.C. § 102, a reference must teach every aspect of the claimed invention either explicitly or implicitly. Any feature not directly taught must be inherently present [emphasis added]. Appellant submits MPEP § 2131 provides: "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631 (Fed. Cir. 1987). 'The identical invention must be shown in as complete detail as contained in the...claim.' *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236 (Fed. Cir. 1989). The elements must be arranged as required by the claim." MPEP § 2141 sets forth the Graham inquiries for a rejection under 35 U.S.C. § 103. As Appellant describes in detail below, Appellant submits there exist clear errors in the Examiner's rejections and/or the Examiner's omissions of one or more aspects of a *prima facie* rejection.

Regarding claim 1, Appellant submits the cited portions of the cited reference fail to disclose the subject matter of claim 1. As an example, Appellant submits the cited portions of the cited reference fail to disclose "determining local interface and next neighbor information for the

network device." F1 The Examiner cites "(figure 7, items 114, 116, 120, 126, 122, 118, and 124)" of the Hansen reference as allegedly disclosing such feature. F2 However, Appellant notes Figure 7 of the Hansen reference merely purports to be an illustration of a configuration manager GUI, but does not appear to disclose any method steps. F3

As another example, Appellant submits the cited portions of the cited reference fail to disclose "determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database." F4 While the Examiner cites "(column 5, lines 35-64; Subsystem is a logical link database)," F5 Appellant notes the cited portion of the cited reference states, "The data and programming instruction are stored in the memory subsystem 6...." F6 Appellant sees no teaching as to "determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database." F7

As yet another example, Appellant submits the cited portions of the cited reference fail to disclose "creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database." F8 While the Examiner cites "(column 15, lines 30-50; Unconnected PCI slot are unassociated connection), F9 Appellant notes col. 15, lines 33-39, state, "As may now be seen, the various network entities, as well as unconnected connection interfaces, are graphically displayed on the backplane bitmap 220 using information contained in the bitmap section 36 of the configuration script 12-N and the local configuration file 20 for the Compaq router 122." F10

However, Appellant notes col. 5, lines 49-52, as the Examiner cited in alleging "Subsystem is a logical link database," F11 states "If a particular network device does not have a configuration script, a configuration file cannot be constructed by the network device configuration tool 10." F12 Accordingly, Appellant submits the Examiner's apparent interpretation of the teachings of the prior art would appear to render them inoperable. F13 Thus, Appellant submits the cited portions of the cited reference cannot disclose the subject matter recited in claim 1.

As yet another example, Appellant submits the cited portions of the cited reference fail to disclose "storing the new logical configuration link in the logical link database." F14 While the Examiner cites "(column 13, lines 10-30)," F15 Appellant submits col. 13, lines 22-26, state, "If either the origination or destination device or entity do not have an available slot which is connectable to the other device or entity, a determination is made at step 156 that the devices/entities cannot be connected." F16 Appellant submits the cited portion of the cited reference fails to disclose "storing the new logical configuration link in the logical link database." F17

As a further example, Appellant submits the cited portions of the cited reference fail to disclose "sending the new logical configuration link to the network device." F18 While the Examiner cites "(column 14, lines 41-60)," F19 Appellant notes col. 14, lines 48-50, states "...before saving the constructed local configuration file 20 to the memory subsystem and associating it with the device." F20 Appellant submits the cited portion of the cited reference does not appear to disclose "sending the new logical configuration link to the network device." F21

Regarding claim 2, Appellant submits the cited portions of the cited reference fail to disclose "selecting a link type." F22 While the Examiner cites "(column 13, lines 1-10; x.25, frame relay, PPP and HDLC are link types," F23 Appellant submits the Examiner has alleged, with respect to claim 1, from which claim 2 depends, that "Subsystem is a logical link database." F24 Appellant submits the Examiner doesn't provide any evidence that "Subsystem" includes any information pertaining to "frame relay, PPP and HDLC." F25 Thus, Appellant submits the Examiner's apparent interpretation of the teachings of the prior art would appear to render them inoperable. F26

As another example, Appellant submits the cited portions of the cited reference fail to disclose "selecting a link numbering type for the new logical configuration link." F27 While the Examiner alleges "(column 11, lines 13-30; PCI slots are numbered configuration links)," F28 Appellant submits such allegation does not disclose a step of "selecting a link numbering type...." F29

As a further example, Appellant submits the cited portions of the cited reference fail to disclose "selecting a link application for the new logical configuration link." F30 While the Examiner alleges "(column 14, lines 5-25; The script commands are applications; column 13, lines 65-column 14, lines 5)," F31 Appellant notes the Examiner alleged with respect to "creating a new logical configuration link..." of claim 1, from which claim 2 depends, "Unconnected PCI slot are unassociated connection." F32 While the Examiner alleges "The script commands are applications," F31 Appellant sees no allegation by the Examiner that "the script commands" disclose link applications for "unconnected PCI slot," F33 which the Examiner appears to allege

disclose "the new logical configuration link." F34 Thus, Appellant submits the Examiner's allegations appear to be inconsistent and would render the purported teachings of the cited reference inoperable. F35

As yet another example, Appellant submits the cited portions of the cited reference fail to disclose "selecting a sub layer interface type for the new logical configuration link." F36 While the Examiner cites "(column 14, lines 15-25; Connection identifiers are configuration links)," F37 Appellant notes the Examiner alleged, with respect to "creating a new logical configuration link" of claim 1, from which claim 2 depends, "Unconnected PCI slot are unassociated connection." F38 Thus, Appellant submits "connection identifiers are configuration links" is inconsistent with the purported teachings alleged by the Examiner with respect to claim 1, thereby apparently rendering such teachings inoperable. F39 Moreover, Appellant submits "connection identifiers are configuration links" fails to disclose "selecting a sub layer interface type...." F40

As yet another example, Appellant submits the cited portions of the cited reference fail to disclose "creating a first endpoint for the new logical configuration link" and "creating a second endpoint for the new logical configuration link." F41 While the Examiner cites "(column 13, lines 10-30)," F42 Appellant submits col. 13, lines 22-26, states, "If either the origination or destination device or entity do not have an available slot which is connectable to the other device or entity, a determination is made at step 156 that the devices/entities cannot be connected." F43 Appellant submits the cited portion of the cited reference fails to disclose "creating a first endpoint for the new logical configuration link" F44and "creating a second endpoint for the new logical configuration link." F45

Regarding claim 3, Appellant submits the cited portion of the cited reference fails to disclose "selecting the link type from among a group consisting of: point-to-point, point-to-IP, and point-to-subnet." F46 While the Examiner cites "(column 13, lines 1-10; x.25, frame relay, PPP and HDLC)," F47 Appellant notes the inconsistency Appellant alleges with respect to the Examiner's allegations regarding "selecting a link type" in claim 2, from which claim 3 depends. F48 Thus, Appellant submits the Examiner's allegations with respect to claim 3 also render the Examiner's apparent interpretation of the purported teachings of the cited portions of the cited reference inoperable. F49

Regarding claim 4, Appellant submits the cited portions of the cited reference fail to disclose "selecting the link numbering type from a group consisting of: a numbered type and an unnumbered type." F50 While the Examiner cites "column 11, lines 13-30; PCI slots are numbering type, column 13, lines 28-45; a list of connection interface is un-number type)," F51 Appellant notes the inconsistency Appellant alleges with respect to the Examiner's allegations regarding "selecting a link numbering type..." in claim 2, from which claim 4 depends. F52 Thus, Appellant submits the Examiner's allegations with respect to claim 4 also render the Examiner's apparent interpretation of the purported teachings of the cited portions of the cited reference inoperable. F53

Regarding claim 7, Appellant submits the cited portions of the cited reference fail to disclose "modifying a logical configuration link in the logical link database." F54 While the Examiner cites "(column 11, lines 41-53; Editing is modifying)," F55 Appellant notes the Examiner alleged "Unconnected PCI are unassociated connection" as purportedly teaching "creating a new

logical configuration link..." in claim 1, from which claim 7 depends. F56 Appellant sees no reference to such "unconnected PCI" in "(column 11, lines 41-53; Editing is modifying)," as alleged by the Examiner. F57 Thus, Appellant submits the cited portions of the cited reference fail to disclose the subject matter of claim 7.

Regarding claim 8, Appellant submits the cited portions of the cited reference fail to disclose "deleting a logical configuration link in the logical link database." F58 While the Examiner cites "(column 10, lines 1-20)," F59 Appellant notes the Examiner alleged "Unconnected PCI are unassociated connection" as purportedly teaching "creating a new logical configuration link..." in claim 1, from which claim 8 depends. F60 Appellant sees no reference to such "unconnected PCI" in "(column 10, lines 1-20)," as alleged by the Examiner. F61 Moreover, Appellant submits teachings in "(column 10, lines 1-20)" appear to be inconsistent with "unconnected PCI." F62 For example, "telnet to this device," "view ip addresses," and "view ipx addresses" appear to be inconsistent with "unconnected PCI," as cited by the Examiner with respect to claim 1, from which claim 8 depends. F63 Thus, Appellant submits the cited portions of the cited reference fail to disclose the subject matter of claim 8.

Regarding claim 9, Appellant notes the Examiner states "As per claim 9, it is of the same scope as claim 1. Supra." F64 Appellant respectfully disagrees and notes claim 9 is directed to different subject matter than claim 1. F65 However, to the extent the Examiner relies on the Examiner's rejection of claim 1 to also reject claim 9, Appellant reiterates what Appellant alleges to be the deficiencies of the Examiner's rejection of claim 1, as Appellant discussed above.

Regarding claim 11, Appellant submits the cited portions of the cited reference fail to disclose "wherein the processing system determines local interface and next neighbor information for the network device." F66 While the Examiner cites "(figure 7, items 114, 116, 120, 126, 122, 118, and 124)," F67 Appellant submits Figure 7 of the Hansen reference merely purports to be an illustration of a configuration manager GUI, but does not appear to disclose "wherein the processing system determines local interface and next neighbor information for the network device." F68

Regarding claim 12, Appellant submits the cited portions of the cited reference fail to disclose "wherein the processing system determines whether the local interface and next neighbor information is associated with one of the logical configuration links stored in the logical link database." F69 While the Examiner cites "(column 15, lines 30-50; Unconnected PCI slot are unassociated connection)," F70 Appellant submits the "Unconnected PCI slot are unassociated connection" alleged by the Examiner fails to disclose, for example, "next neighbor information" and "the logical link database." F71 Thus, Appellant submits the Examiner has not made a *prima facie* showing of anticipation with respect to the subject matter of claim 12.

Regarding claim 13, Appellant submits the cited portions of the cited reference fail to disclose "wherein the processing system creates a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links stored in the logical link database." F72 While the Examiner cites "(column 13, lines 10-30)," F73 Appellant submits col. 13, lines 22-26, state, "If either the origination or destination device or entity do not have an available slot which is connectable to the other device or entity, a

determination is made at step 156 that the devices/entities cannot be connected." F74 Appellant submits the cited portion of the cited reference fails to disclose "wherein the processing system creates a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links stored in the logical link database." F75

Regarding claim 14, Appellant submits the cited portions of the cited reference fail to disclose "wherein the processing system causes the new logical configuration link to be stored in the logical link database." F76 While the Examiner cites "(column 13, lines 10-30)," F77 Appellant submits col. 13, lines 22-26, state, "If either the origination or destination device or entity do not have an available slot which is connectable to the other device or entity, a determination is made at step 156 that the devices/entities cannot be connected." F78 Appellant submits the cited portion of the cited reference fails to disclose "wherein the processing system causes the new logical configuration link to be stored in the logical link database." F79

Regarding claim 16, Appellant submits the cited portions of the cited reference fail to disclose "wherein the processing system causes the new logical configuration link to be sent to the network device." F80 While the Examiner cites "(column 14, lines 41-60)," F81 Appellant notes col. 14, lines 48-50, states "...before saving the constructed local configuration file 20 to the memory subsystem and associating it with the device." F82 Appellant submits the cited portion of the cited reference does not appear to disclose "wherein the processing system causes the new logical configuration link to be sent to the network device." F83

Regarding claim 17, Appellant submits the cited portions of the cited reference fail to disclose "wherein creating the new logical configuration link when the local interface and next

neighbor information is not associated with any of the logical configuration links in the logical link database occurs based on interfaces information entered by a user." F84 The Examiner states "As per claim 17, it is rejected under the same rationale as claim 1. Supra." F85 Appellant respectfully disagrees and notes claim 17 is directed to different subject matter than claim 1. F86 However, to the extent the Examiner relies on the Examiner's rejection of claim 1 to also reject claim 17, Appellant reiterates what Appellant alleges to be the deficiencies of the Examiner's rejection of claim 1, as Appellant discussed above.

Regarding claim 18, Appellant submits the cited portions of the cited reference fail to disclose the subject matter recited in claim 18. F87 Appellant notes the Examiner states "As per claim 18, it is rejected under the same rationale as claim 2." F88 Appellant respectfully disagrees and notes claim 18 is directed to different subject matter than claim 2. F89 To the extent the Examiner relies on the Examiner's rejection of claim 2 to also reject claim 18, Appellant reiterates what Appellant alleges to be the deficiencies of the Examiner's rejection of claim 2, as Appellant discussed above. Nonetheless, Appellant submits the Examiner has not alleged anticipation with respect to subject matter recited in claim 18. F90 As one example, Appellant submits claim 18 recites "populating form panels with the link type, the link numbering type, the link application, and the sub layer interface type," F91 while claim 2 does not. F92 As another example, Appellant submits claim 18 recites "receiving user input of interfaces information." F93 As yet another example, Appellant submits claim 18 recites "validating the interfaces information." F94 As a further example, Appellant submits claim 18 recites "creating a link in accordance with the interfaces information." F95 As another example, Appellant submits claim 18 recites

"provisioning the link." F96 Appellant submits the Examiner has not alleged any teaching as to such subject matter. F97 Thus, Appellant submits the Examiner has not made a *prima facie* showing of anticipation with respect to claim 18.

Rejection of Claim 5 under 35 U.S.C. 103(a) as being unpatentable over Hansen in view of Hansen US Patent 5,838,907 [sic] in view of Hardwick US Patent 5,550,816

MPEP § 2143 describes examples of basic requirements of a *prima facie* case of obviousness under 35 U.S.C. § 103. As Appellant describes in detail below, Appellant submits there exist clear errors in the Examiner's rejections and/or the Examiner's omissions of one or more aspects of a *prima facie* rejection.

Regarding claim 5, Appellant submits the cited portions of the cited reference fail to render unpatentable the subject matter of claim 5. As an example, Appellant submits the cited portions of the cited reference fail to disclose or suggest "selecting the link application from a group consisting of: Internet Protocol Forwarding, Multi-Protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching." F98 Appellant notes the Examiner alleges, with respect to claim 2, from which claim 5 depends, "The script commands are applications." F99 However, the Examiner now alleges "Hardwick teaches the step of selecting a link application from a group consisting of: Internet Protocol Forwarding, Multi-Protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching (column 43, lines 60-column 44, lines 5)." F100 Appellant submits the Examiner's allegations as to purported teachings of the cited references with respect to the subject matter of claims 2 and 5 are inconsistent and contradictory, thereby rendering the supposed combination of the purported teachings inoperable.

F101 Moreover, Appellant submits the Examiner's alleged motivation to combine the references does not appear to pertain to the supposed combination of the purported teachings. F102 Thus, Appellant submits the Examiner has not made a *prima facie* showing of obviousness with respect to the subject matter of claim 5.

Rejection of claim 6 under 35 U.S.C. 103(a) as being unpatentable over Hansen in view of Hansen US Patent 5,838,907 [sic] in view of Chui US Patent 2002/0165978

MPEP § 2143 describes examples of basic requirements of a *prima facie* case of obviousness under 35 U.S.C. § 103. Appellant submits there exist clear errors in the Examiner's rejections and/or the Examiner's omissions of one or more aspects of a *prima facie* rejection.

Regarding claim 6, Appellant submits the cited portions of the cited reference fail to render unpatentable the subject matter of claim 6. As an example, Appellant submits the cited portions of the cited reference fail to disclose or suggest "selecting the sub layer interface type from a group consisting of: Packet Over Sonet, Asynchronous Transfer Mode, and GigEthernet." F103 Appellant notes the Examiner alleges, with respect to claim 2, from which claim 6 depends, "Connection identifiers are configuration links." F104 However, the Examiner now alleges "Chui teaches selecting a sub layer interface type comprises the step of: Selecting the sub-layer interface type from a group consisting of: Packet over Sonet, Asynchronous Transfer Mode, and GigEthernet." F105 Appellant submits the Examiner's allegations as to purported teachings of the cited references with respect to the subject matter of claims 2 and 6 are inconsistent and contradictory, thereby rendering the supposed combination of the purported teachings inoperable. F106 Moreover, Appellant submits the Examiner's alleged motivation to combine the references

does not appear to pertain to the supposed combination of the purported teachings. F107 Thus, Appellant submits the Examiner has not made a *prima facie* showing of obviousness with respect to the subject matter of claim 6.

APPENDIX

CLAIMS SECTION

1. (Original) A network administration method for provisioning logical configuration links for at least two network devices through a dedicated graphical user interface form, the method comprising:

selecting a network device having at least one network interface through the dedicated graphical user interface form;

determining local interface and next neighbor information for the network device;

determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database;

creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database;

storing the new logical configuration link in the logical link database;

validating the new logical configuration link;

sending the new logical configuration link to the network device; and

displaying a graphical representation of the new logical configuration link on a display device.

2. (Original) The method of claim 1, wherein the step of creating a new logical

configuration link further comprises the steps of:

selecting a link type;

selecting a link numbering type for the new logical configuration link;

selecting a link application for the new logical configuration link;

selecting a sub layer interface type for the new logical configuration link;

creating a first endpoint for the new logical configuration link; and

creating a second endpoint for the new logical configuration link.

3. (Original) The method of claim 2, wherein the step of selecting the link type further comprises the step of:

selecting the link type from among a group consisting of: point-to-point, point-to-IP, and point-to-subnet.

4. (Original) The method of claim 2, wherein the step of selecting a link numbering type further comprises the step of:

selecting the link numbering type from a group consisting of: a numbered type and an unnumbered type.

5. (Original) The method of claim 2, wherein the step of selecting a link application further comprises the step of:

selecting the link application from a group consisting of: Internet Protocol Forwarding,

Multi-Protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching.

6. (Original) The method of claim 2, wherein the step of selecting a sub layer interface type further comprises the step of:

selecting the sub layer interface type from a group consisting of: Packet Over Sonet, Asynchronous Transfer Mode, and GigEthernet.

7. (Original) The method of claim 1, further comprising the step of:

modifying a logical configuration link in the logical link database.

8. (Original) The method of claim 1, further comprising the step of:

deleting a logical configuration link in the logical link database.

9. (Original) Apparatus for provisioning logical configuration links comprising:

a logical link database for storing logical configuration links;

a processing system coupled to the logical link database for accessing the logical link database; and

a display device coupled to the processing system for displaying a graphical user interface form comprising a graphical representation of a logical configuration link.

10. (Original) The apparatus of claim 9 wherein the display device provides an ability to select a network device having at least one network interface through the graphical user interface form.

11. (Original) The apparatus of claim 9 wherein the processing system determines local interface and next neighbor information for the network device.

12. (Original) The apparatus of claim 11 wherein the processing system determines whether the local interface and next neighbor information is associated with one of the logical configuration links stored in the logical link database.

13. (Original) The apparatus of claim 12 wherein the processing system creates a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links stored in the logical link database.

14. (Original) The apparatus of claim 13 wherein the processing system causes the new logical configuration link to be stored in the logical link database.

15. (Original) The apparatus of claim 14 wherein the processing system validates the new logical configuration link.

16. (Original) The apparatus of claim 15 wherein the processing system causes the new logical configuration link to be sent to the network device.

17. (Previously Presented) The method of claim 1 wherein creating the new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database occurs based on interfaces information entered by a user.

18. (Previously Presented) A method comprising:

selecting a link type;

selecting a link numbering type;

selecting a link application;

selecting a sub layer interface type;

creating a first endpoint;

creating a second endpoint;

populating form panels with the link type, the link numbering type, the link application, and the sub layer interface type;

receiving user input of interfaces information;

validating the interfaces information;

creating a link in accordance with the interfaces information; and

provisioning the link.

CLAIM SUPPORT AND DRAWING ANALYSIS SECTION

1. (Original) A network administration method for provisioning logical configuration links for at least two network devices through a dedicated graphical user interface form **{Page 31, line 20, through page 32, line 13; Fig. 5}**, the method comprising:

selecting a network device having at least one network interface through the dedicated graphical user interface form **{Page 31, line 23, through page 32, line 1; Fig. 5, step 501}**;

determining local interface and next neighbor information for the network device **{Page 32, lines 1 and 2; Fig. 5, step 502}**;

determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database **{Page 32, lines 2 through 5; Fig. 5, step 503}**;

creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database **{Page 32, lines 6 and 7; Fig. 5, step 504}**;

storing the new logical configuration link in the logical link database **{Page 32, lines 7 and 8; Fig. 5, step 505}**;

validating the new logical configuration link **{Page 32, lines 8 and 9; Fig. 5, step 506}**;

sending the new logical configuration link to the network device **{Page 32, lines 9 and 10; Fig. 5, step 507}**; and

displaying a graphical representation of the new logical configuration link on a display

device **{Page 32, lines 10 and 11; Fig. 5, step 508}**.

2. (Original) The method of claim 1, wherein the step of creating a new logical configuration link further comprises **{Page 32, lines 14 through 16; Fig. 6}** the steps of:

selecting a link type **{Page 32, lines 16 and 17; Fig. 6, step 601}**;

selecting a link numbering type for the new logical configuration link **{Page 32, lines 18 and 19; Fig. 6, step 603}**;

selecting a link application for the new logical configuration link **{Page 32, lines 21 and 22; Fig. 6, step 605}**;

selecting a sub layer interface type for the new logical configuration link **{Page 32, lines 24 and 25; Fig. 6, step 607}**;

creating a first endpoint for the new logical configuration link **{Page 33, line 1; Fig. 6, step 609}**; and

creating a second endpoint for the new logical configuration link **{Page 33, line 2; Fig. 6, step 610}**.

3. (Original) The method of claim 2, wherein the step of selecting the link type further comprises **{Page 32, line 17}** the step of:

selecting the link type from among a group consisting of: point-to-point, point-to-IP, and point-to-subnet **{Page 32, lines 17 and 18; Fig. 6, step 602}**.

4. (Original) The method of claim 2, wherein the step of selecting a link numbering type further comprises **{Page 32, lines 19 and 20}** the step of:

selecting the link numbering type from a group consisting of: a numbered type and an unnumbered type **{Page 32, lines 20 and 21; Fig. 6, step 604}**.

5. (Original) The method of claim 2, wherein the step of selecting a link application further comprises **{Page 32, line 22}** the step of:

selecting the link application from a group consisting of: Internet Protocol Forwarding, Multi-Protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching **{Page 32, lines 22 through 24; Fig. 6, step 606}**.

6. (Original) The method of claim 2, wherein the step of selecting a sub layer interface type further comprises **{Page 32, line 25}** the step of:

selecting the sub layer interface type from a group consisting of: Packet Over Sonet, Asynchronous Transfer Mode, and GigEthernet **{Page 32, line 25, through page 33, line 1; Fig. 6, step 608}**.

7. (Original) The method of claim 1, further comprising the step of:

modifying a logical configuration link in the logical link database **{Page 32, line 12; Fig. 5, step 509}**.

8. (Original) The method of claim 1, further comprising the step of:

deleting a logical configuration link in the logical link database **{Page 32, lines 12 and 13; Fig. 5, step 510}**.

9. (Original) Apparatus for provisioning logical configuration links **{Page 33, line 3, through Page 35, line 5; Fig. 7}** comprising:

a logical link database for storing logical configuration links **{Page 33, line 13; Fig. 7, logical link database 705}**;

a processing system coupled to the logical link database for accessing the logical link database **{Page 33, lines 6, 7, 13, and 14; Fig. 7, processing system 704}**; and

a display device coupled to the processing system for displaying a graphical user interface form comprising a graphical representation of a logical configuration link **{Page 33, lines 4-6, 14, and 15; Fig. 7, display device 701}**.

10. (Original) The apparatus of claim 9 wherein the display device provides an ability to select a network device having at least one network interface through the graphical user interface form **{Page 33, lines 14 and 15}**.

11. (Original) The apparatus of claim 9 wherein the processing system determines local interface and next neighbor information for the network device **{Page 33, lines 16 and 17}**.

12. (Original) The apparatus of claim 11 wherein the processing system determines whether the local interface and next neighbor information is associated with one of the logical configuration links stored in the logical link database **{Page 33, lines 18 and 19}**.

13. (Original) The apparatus of claim 12 wherein the processing system creates a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links stored in the logical link database **{Page 33, lines 20 through 22}**.

14. (Original) The apparatus of claim 13 wherein the processing system causes the new logical configuration link to be stored in the logical link database **{Page 33, lines 23 and 24}**.

15. (Original) The apparatus of claim 14 wherein the processing system validates the new logical configuration link **{Page 33, line 24}**.

16. (Original) The apparatus of claim 15 wherein the processing system causes the new logical configuration link to be sent to the network device **{Page 33, lines 25 and 26}**.

17. (Previously Presented) The method of claim 1 wherein creating the new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database occurs based on interfaces

information entered by a user **{Page 12, line 2, through page 31, line 19; Figs. 3A-3C and 4}**.

18. (Previously Presented) A method comprising:

selecting a link type **{Page 13, lines 15, through page 14, line 23; Fig. 3A, step 303}**;

selecting a link numbering type **{Page 14, lines 24, through page 17, Table 2; Fig. 3A, step 313}**;

selecting a link application **{Page 17, lines 2 through 8; Fig. 3A, step 319}**;

selecting a sub layer interface type **{Page 17, line 9, through page 19, line 11; Fig. 3A, step 327}**;

creating a first endpoint **{Page 19, line 12, through page 21, line 8; Fig. 3B, step 339}**;

creating a second endpoint **{Page 21, line 9, through page 22, line 10; Fig. 3B, step 347}**;

populating form panels with the link type, the link numbering type, the link application, and the sub layer interface type **{Page 22, lines 11 through 16; Fig. 3C, step 355}**;

receiving user input of interfaces information **{Page 22, lines 17, through page 23, line 9; Fig. 3C, step 359}**;

validating the interfaces information **{Page 23, line 10, through page 24, Table 5; Fig. 3C, step 366}**;

creating a link in accordance with the interfaces information **{Page 23, line 10, through page 24, line 13; Fig. 3C, step 366}**; and

provisioning the link {Page 24, lines 2 through 13; Fig. 3C, step 370}.

MEANS OR STEP PLUS FUNCTION ANALYSIS SECTION

EVIDENCE SECTION

AFFIDAVITS AND DECLARATIONS

As presently advised, no evidence was submitted pursuant to 37 C.F.R. §§ 1.130, 1.131, or 1.132.

OTHER EVIDENCE FILED PRIOR TO THE NOTICE OF APPEAL

In the Notice of References Cited (Form PTO-892) included with the Office action mailed 03-18-2009, the Examiner cited U.S. Patent No. 5,838,907, issued to Hansen, U.S. Patent No. 5,550,816, issued to Hardwick and U.S. Patent Publication No. 2002/0165978 to Chui. As the Examiner relied upon the following evidence in support of final rejection, Appellant relies upon such evidence in the appeal: U.S. Patent No. 5,838,907, issued to Hansen, U.S. Patent No. 5,550,816, issued to Hardwick and U.S. Patent Publication No. 2002/0165978 to Chui, copies of which are provided below.

12-28-01 A

12/19/01 U.S. PTO

UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))
Attorney Docket No. 1400.1374890 Total Pages 47
First Inventor or Application Identifier Proulx, et al.
Title METHOD AND SYSTEM FOR IP LINK MANAGEMENT
Express Mail Label No. EL728113810US

APPLICATION ELEMENTS *See MPEP chapter 600 concerning utility patent application contents.*	*ADDRESS TO:* Assistant Commissioner for Patents Box Patent Application Washington, DC 20231

1. ☐ Fee Transmittal Form
(Submit an original, and a duplicate for fee processing)
2. ☒ Specification *Total Pages* 39
(preferred arrangement set forth below)
- Descriptive title of the Invention
- Cross References to Related Applications
- Statement Regarding Fed sponsored R & D
- Reference to Microfiche Appendix
- Background of the Invention
- Brief Summary of the Invention
- Brief Description of the Drawings *(if filed)*
- Detailed Description
- Claim(s)
- Abstract of the Disclosure
3. ☒ Drawings *(35 USC 113) Total Sheets* 8
4. Oath or Declaration *Total Pages*
a. ☐ Newly executed (original or copy)
b. ☐ Copy from a prior application (37 CFR 1.63(d))
(for continuation/divisional with Box 16 completed)
i. ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
5. ☐ Microfiche Computer Program *(Appendix)*
6. ☐ Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)
a. ☐ Computer Readable Copy
b. ☐ Paper Copy (identical to computer copy)
c. ☐ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

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FILING OF A UNITED STATES PATENT APPLICATION

METHOD AND SYSTEM FOR IP LINK MANAGEMENT

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METHOD AND SYSTEM FOR IP LINK MANAGEMENT

FIELD OF THE DISCLOSURE

The present invention relates to the field of data communications networks, and more particularly to a method for network management for end-to-end IP link management between network devices via a dedicated graphical user interface.

BACKGROUND

A data communications network transmits data among and between network devices (often referred to as nodes) which are physically and logically connected to the network. The physical configuration of a network changes when network devices are added to or removed from the network, and when physical connections between devices are made or changed. The logical configuration of a network changes as logical connections are established between communicating network devices utilizing the physical structure of the network. Network devices include devices that can send and/or receive data, as well as devices that can forward data. Network devices that can forward data are important in all but the very simplest networks. In most networks, direct connections do not exist between most network devices. Instead, each network device is connected to a limited number of adjacent network devices. For network devices to be able to communicate when they are not physically connected, the two communicating network devices rely on intermediate network devices to forward communications between them.

Data transmitted over data communications networks are generally referred to as packets or frames. Both of these terms relate to the same subject -- data to be transmitted. A string of data is fragmented into packets at the sending network device and sent over the network to the receiving network device. The receiving network device assembles the individual packets in the

correct order to reconstruct the original data string. The particular manner in which packet fragmentation and transmission occurs from one network layer to another is defined by the various data communication protocols. One prominent data communication protocol is Transmission Control Protocol, or TCP, and another is Internet Protocol, usually referred to simply as IP, or IP protocol. Other examples of data communication protocols are Multi-Protocol Label Switching, or MPLS, Border Gateway Protocol, or BGP, and User Datagram Protocol, or UDP.

Data communications networks can be conceptualized as comprising a hierarchy of communications layers that establish different types of connections between network devices. The Open Systems Interconnect (OSI) Reference Model developed by the International Standards Organization (ISO) is generally used to describe the structure and function of data communications protocols. A layer does not define a single protocol, but rather a data communications function that may be carried out by any number of protocols. Thus, each layer may contain various protocols, each offering a service appropriate to the function of that layer. The more basic functions are provided at the lower layers, while successively more sophisticated functions are provided at successively higher layers. In the OSI model, each lower layer in the model provides data communications capabilities or functions that are utilized by the next higher layer. A schematic illustration of the OSI seven-layer model is shown in Figure 2. As seen in Figure 2, the seven layers in the OSI model, beginning from the bottom, are physical layer 205, data link layer 210, network layer 215, transport layer 220, session layer 225, presentation layer 230, and application layer 235. In the OSI model, the IP protocol is commonly considered as being associated with the third layer, network layer 215.

In an IP network, each sending and receiving device is assigned a 32-bit address. The address is usually written as a series of four "octets" (e.g., numbers within a range of 0-255) separated by periods. Examples of IP addresses are 127.0.0.1, 205.160.34.112, 23.1.99.244, etc. Each IP packet sent over an IP network includes the sender's IP address and the recipient's IP address. The recipient's IP address is used to route the packet from the sending network device

via intermediate network devices that have IP forwarding capabilities to the recipient network device.

An example of a simple network that illustrates IP forwarding and logical links is shown in Figure 1. The network of Figure 1 includes two types of network devices: non-IP-forwarding devices 105, 110, 115 and 120 (represented by rectangles and which may, for example, comprise personal computers or computer workstations), and IP-forwarding devices 125, 130, 135, 140, 145 and 150 (represented by circles and which may, for example, comprise IP routers). The network devices in Figure 1 are interconnected by a various bi-directional connections or links 160, 162, 164, 166, 168, 170, 172, 174, 176, 178 and 180, represented in Figure 1 by two-headed arrows.

Links 160-180 may comprise direct physical connections between the adjacent network devices, or may comprise logical connections that involve intermediate devices, but are "seen" by the connected devices as direct connections. For example, network device 110 is connected to network device 130 via link 166. That is, network device 110 knows that if it sends a communication via its interface port connected to link 166, the communication will be received by network device 130. It doesn't matter to network device 110 whether link 166 is a single, physical connection, or a series of physical connections. Logical links such as links 160-180 that connect two network devices are sometimes referred to as "IP links." The term "IP links" as used herein includes logical links that use the IP protocol, as well as logical links utilizing other protocols, e.g., MPLS.

In the network portrayed in Figure 1, network device 110 is connected directly (via link 166) only to network device 130. For network device 110 to communicate to any other network device, the IP forwarding capabilities of network device 130 must be used. In addition to network device 110, to which it is connected via link 166, network device 130 has direct connections to three other network devices 125, 135, and 145, via respective links 160, 168, and 176. Typically, each of links 160, 166, 168 and 176 are connected to separate ports on network

device 130. Each port may be a separate physical interface, or two or more ports may share a single, physical interface. Each port may have its own unique assigned IP address, in which case network device 130, as well of each of its ports, may have distinct IP addresses.

Network device 130 of Figure 1 has been defined to have IP forwarding capabilities. IP forwarding capabilities means that network device 130 must be able to receive an IP packet (intended for delivery to a network device other than network device 130) from one of the IP links to which it is connected, and forward the IP packet along at least one of the other IP links to which it is connected. In the general case where network device 130 is a typical router, network device 130 is able to receive and forward IP packets from and to any of the IP links 160, 166, 168 and 176 to which it is connected, provided, of course, that the links are functional. Similarly, the other network devices 125, 135, 140, 145, and 150 with IP forwarding capabilities are able to receive and forward IP packets from and to any of the IP links to which they are connected.

Should network device 110 wish to communication with, for example, network device 115, there are various paths that the communication could take. The most direct path comprises links 166, 176, and 178. However, other paths include the path comprising links 166, 168, 174, 180 and 178, or even the path comprising links 166, 160, 162, 174, 180 and 178. When network device 110 sends out IP packets to network device 115, it does not know which path the packets will take. Network device 110 simply addresses the packets to network device 115 using network device 115's IP number (129.111.110.9 in the example of Figure1), and sends the packets out over link 166 toward network device 130. What network device 130 does with the packets after receipt depends upon the configuration of network device 130. For example, network device 130 may be configured to forward any packet received from link 166 along link 176. Alternately, network device 130 may be configured to forward packets along links depending on the destination IP number of the packet. Network device 130 may also be programmed to monitor traffic along each link and to adapt its forwarding scheme to traffic

conditions. The manner in which a network device forwards packets depends on the capabilities and configuration of the particular network device.

Thus, even from the simple network illustrated in Figure1, it is apparent that network devices that perform IP forwarding should be properly configured for maximum interoperability to ensure that packets are efficiently routed to their intended destination. The configuration of network devices within a network is one aspect of network management. Network devices may be locally managed or remotely (centrally) managed. Local management of a network device may be accomplished using a workstation or terminal directly connected to the network device. Remote management of a network device may be accomplished from remote terminals or workstations that communicate with the network device via the network, if the network device utilizes a protocol that permits remote management. One protocol used for remote management of network devices is Simple Network Management Protocol (SNMP), which provides a set of commands and parameters that allow communication with and configuration of network devices.

Personnel responsible for management of a network are commonly referred to as network managers. Network management software systems provide tools for network managers to facilitate central management of network devices, particularly when the network devices are widely dispersed geographically or quite numerous. To manage a network device, a network manager must know that the network device exists, how it is connected to the network and to other network devices, and what the capabilities of the network device are. In addition to the network device utilizing a protocol that permits remote management, the network management system used by the network manager must be capable of communication with the network device using the correct protocol.

The configuration of large networks changes frequently due to addition, removal and/or replacement of network devices. To effectively manage large networks such that IP packets are routed correctly over the network, the network manager must know when data forwarding network devices are added or removed. One system used to discover network devices with data

forwarding capabilities is described in U.S. Patent Application No. ________, titled "Method and Apparatus for Automatic Discovery of Network Devices with Data Forwarding Capabilities" assigned to the assignee of the present invention and incorporated by reference herein.

Small networks, i.e., those in which the entire network encompasses a handful of network devices in a localized environment, are relatively easy for a network manager to physically inspect or determine when a network device is added or removed. In large, geographically dispersed networks with hundreds of network devices, however, it is impossible for the network manager to perform a first hand inspection to determine the state of the entire network at any given time.

A managed network often encompasses a plurality of subnets. A subnet is a group of network devices belonging to a specific block, or subset, of IP addresses. For example, one type of subnet comprises IP numbers that share the first three octets, as for example 215.223.46.x (where "x" can be any number from 0 to 255). Larger subnets may share only the first two octets (e.g. 215.223.x.y). In addition to subnets, networks may also include individual IP numbers or ranges of IP numbers. A network manager generally knows which subnets are included in the network being managed. However, the network manager will not necessarily know beforehand the IP number of a network device to be added to a network, particularly if the IP number is not within one of the network's known subnets.

In addition to knowing the identity and physical configuration of the network devices themselves, it is also important for the network manager to be able to monitor logical connections between network devices. A logical connection exists between network devices when at least one port of a first network device is configured so that a message sent out through that port would arrive at a known destination (either a network address or a second network device). The destination may be a particular port or interface on another network device, a particular IP address, or a particular subnetwork. One system used to discover logical links between network devices is described in U.S. Patent Application No. __________, titled

"Method and Apparatus for Automatic Discovery of Logical Links between Network Devices" assigned to the assignee of the present invention, and incorporated by reference herein.

Several prior art network management systems provide tools that allow a network manager to gather certain information about network devices within the network. For example, one prior art system allows a network manager to send queries to each possible IP number in a subnet or other range of IP numbers ("IP number polling") to determine whether a network device is associated with that IP number. If a network device is found, it is automatically added to the network management system's database of managed network devices. This prior art network device discovery system thus ascertains newly added network devices, however, it cannot distinguish between network devices with IP forwarding capabilities and those without. Furthermore, it does not discover network devices outside of the range of IP numbers being searched, nor does it allow a network manager to exert control over which of the newly discovered network devices are to be managed by the network management system.

Other prior art network management systems are only capable of creating and configuring network devices (routers) on a per router basis only, nor do they employ an "IP link" concept for configuring both endpoints (router interfaces) at the same time. This limitation is often prone to errors. Many prior art network management applications perform IP link configuration using Command Line Interface (CLI) scripts, which are command driven, text-based user interfaces to a network device. CLI scripts tend to be error prone and are not easy to debug. In addition, prior art applications do not provide an IP link network provisioning which includes the Asynchronous Transfer Mode (ATM) path.

Therefore, what is needed is a method of network management that provides the ability to provision both ends of the IP link at the same time, facilitate the matching of the parameters, and handle the underlying layers through one graphical user interface (GUI).

SUMMARY OF THE INVENTION

An embodiment of the present invention provides a method for network management that allows the configuration of IP links (a pair of interfaces) in one step, via a dedicated graphical user interface (GUI) form, even though the management protocols available at the two end links (routers) may differ, e.g., one router might use Simple Network Management Protocol (SNMP) or some other protocol, while the other might use Command Line Interface (CLI) or another protocol. The method comprises gathering information from the user, validating this information, and then sending this information to the appropriate router(s). In one embodiment, the method enables a user to specify various configurations when provisioning an IP link, for example, the type of IP link (Point-to-Point, Point-to-IP, or Point-to-Subnet), the numbering type (Numbered or Unnumbered), the application type (IP Forwarding, MPLS and IP Forwarding, or MPLS only), and the sub-layer interfaces to be used (Packet Over Sonet, Asynchronous Transfer Mode, GigEthernet, and others). In addition, the method allows the IP link to be associated to existing (already created) router interface(s), or the interfaces can be created as part of the IP link creation process.

When provisioning the IP link as disclosed in the various embodiments herein, all the data is validated to ensure that no errors are introduced that would prevent IP/MPLS connectivity. The method for provisioning of IP links as taught herein includes, but is not limited to, creation of an IP link, deletion of the IP link, and modification of the IP link. The embodied provisioning of IP links creates and/or modifies the router interface on the router(s) in the network, the MPLS attribute on the router(s), and the lower layer connections to achieve connectivity. With the method, the IP link status is associated with the router interfaces used and the network path over which IP traffic is carried.

An advantage of at least one embodiment of the present invention is that end-to-end provisioning of the IP link is possible, even when routers are not physically directly connected, i.e., across a network cloud.

Another advantage of at least one embodiment of the present invention is that provisioning may be accomplished as a one-step activity conducted via a dedicated GUI form.

Another advantage of at least one embodiment of the present invention is that validation of data entered on the dedicated GUI form is provided to avoid incompatible configuration at the ends of the connection, thus reducing routing configuration errors.

A further advantage of at least one embodiment of the present invention is that the method may be applied to network management of networks comprised of equipment from a diverse range of manufacturers to configure IP links in one step, even though the management protocols available at two end routers may be different.

Yet another advantage of at least one embodiment of the present invention is the time savings made possible over current methods which require configuring a router interface on a per router basis.

Other objects, advantages, features and characteristics of the present invention, as well as methods, operation and functions of related elements of structure, and the combinations of parts and economies of manufacture, will become apparent upon consideration of the following description and claims with reference to the accompanying drawings, all of which form a part of the specification, wherein like reference numerals designate corresponding parts in the various figures, and wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic of a data communications network that utilizes data forwarding and logical links;

Figure 2 is a diagram of the Open Systems Interconnect (OSI) Reference Model developed by the International Standards Organization (ISO) generally used to describe the structure and function of data communications protocols;

Figure 3A is a flowchart illustrating a method for providing IP link creation for network management according to at least one embodiment of the present invention;

Figure 3B is a continuation of the flowchart illustrating a method for providing IP link creation for network management according to at least one embodiment of the present invention;

Figure 3C is a further continuation of the flowchart illustrating a method for providing IP link creation for network management according to at least one embodiment of the present invention; and

Figure 4 is an illustration of an example of an IP link provisioning GUI according to at least one embodiment of the present invention.

Figure 5 is a flow diagram illustrating a method for provisioning logical configuration links for network devices in accordance with an embodiment of the invention.

Figure 6 is a flow diagram illustrating a process for creating a new logical configuration link in accordance with an embodiment of the present invention.

Figure 7 is a block diagram illustrating apparatus for provisioning logical configuration links in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF THE FIGURES

Figures 3A - 4 illustrate a method for provisioning IP links. In one or more embodiments, the invention comprises a network and service management system, such as, for example, the Alcatel 5620 Network Management System. In various embodiments, the invention is implemented by means of software programming operating on personal computers, computer workstations and or other computing platforms. In the following description, numerous specific details are set forth to provide a thorough description of the invention. However, it will be apparent to one skilled in the art that the invention may be practiced without these specific details. In other instances, well-known features have not been described in detail so as not to obscure the invention.

Figures 3A, 3B, and 3C comprise a flowchart illustrating a method for providing IP link creation for network management according to at least one embodiment of the present invention. The IP link component of the network management system (NMS) as disclosed herein is used to configure a router interface and represent a logical IP connectivity between two routers. When a user configures an IP link of the network management system as disclosed herein, the user can configure the category of the link that identifies whether the IP link is a peer, access, or within network IP link. The endpoint interface configurations of an IP link determine what IP packets are being carried through the IP link, and hence the type of application one may run between the two routers. These applications include IP forwarding, MPLS and IP forwarding, or MPLS. The IP routing protocols (ISIS, BGP, OSPF) can use the IP link to route packets between routers if the link has been enabled with IP forwarding. IP Forwarding IP Link as disclosed herein can run over a NMS Virtual Channel Connection (VCC) path (network cloud) if the IP Link Sub layer type is ATM. The MPLS and IP Forwarding Link is used for enabling MPLS signaling and IP forwarding between two adjacent routers. The MPLS IP Link is used to enable MPLS signaling between two adjacent routers and to disable IP forwarding on some router interfaces where IP forwarding is not supported, but MPLS is supported. The connectivity also helps the NMS user

to route LSP (Label Switched Path). The IP link of the disclosed NMS encapsulates the layer 2 (of the OSI Model) complexity, since in practice the logical connectivity is mapped to a one-hop or multiple hops or paths (across a network cloud). The IP link component of the NMS does not configure the routing protocols, however it does configure the MPLS protocol. The network manager (user) configures the other routing protocols using the router Element Management application or CLI (Command Line Interface).

There are various features of the embodied NMS which are valuable to the network manager, for example, the single sided (point-to-IP or point-to-subnet) IP link is useful for configuring only one side of the IP link, representing the other side on the IP Map with the IP address or subnet address and indicating the status of the IP link (or status of the router interface). That is, the user could use the NMS to "see" an IP link representing access to the Internet, or an IP link showing connectivity to an unmanaged router. The term unmanaged router as used herein refers to a router which is not managed by the embodied NMS, and the term managed router as used herein refers to a router which is managed by the embodied NMS.

Referring to Figure 3A, the first page of the flowchart, the network manager (user) is presented with the option to select a new IP link type to create in step 303. There are three types of IP links that a user may configure: Point-to-Point, Point-to-IP, or Point-to-Subnet. It should be noted that more than one IP link can exist between two routers, however, only one IP link can exist between router interfaces. When the user wants to create a point-to-point link between two routers, if both routers are managed, the user executes step 307 and selects the Point-to-Point IP link type. If one of the routers is not managed by the IP link component of the NMS (network management system) as disclosed herein, the user executes step 305 by selecting the Point-to-IP link type.

Should a user wish to create a "broadcast" interface on a router, the user executes step 309 by selecting the Point-to-Subnet IP type. Interface as used herein refers to an interface on a router, or an (L3) interface, which is an interface with an IP configuration associated with it. In

order to forward IP packets, a router interface must be bound to at least one sub layer interface per RFC2233. Note that an interface is created by the action of creating an IP link from the GUI of an embodiment of the present invention, and is visible in an embodiment of the present invention via the "List Interface" window if the router that contains the router interface is managed by the embodied NMS. An interface can be an endpoint of an IP link, and can be created, configured, or deleted as part of the creation/configuration/deletion of an IP link.

For a point-to-point link selection in step 307 for which both routers are managed by the embodied NMS, the router interface for both routers, i.e. with router A at one end and router B at the other end, would be set to be visible to the user in step 308. If a point-to-IP link selection is made in step 305, only one end is managed by the NMS, and although both endpoints would be visible to the user, the fields related to the unmanaged router or router interface would be hidden (from the user) in tab panels of the GUI form, as indicated in step 306. In a point-to-IP link, the IP address would be that of the router or the router interface on the unmanaged router.

For a point-to-subnet link (broadcast interface) selection in step 309, only one router is managed by the NMS, thus endpoint B would be set to invisible, and all fields related to endpoint B would be hidden in tab panels of the GUI form, as seen in step 311. Thus for point-to-subnet, the NMS user would configure the interface at endpoint A only. By "visible," it is meant that a graphical representation of the routers and IP links would be visible to the network manager (user) in a GUI form, while "invisible" means that a graphical representation of a router would not be visible in GUI form. When the user creates an IP link "point-to-subnet," the subnet is created if it doesn't already exist in the NMS database. The subnet address is taken from the router interface configured on the IP link, and the interface IP address must be a broadcast address, i.e., the IP network mask address is not equal to all ones).

When either step 308 or step 306 has been executed, the user selects a link numbering type in step 313. Table 1 indicates the numbering types supported for interfaces, which are

created are created whenever an IP link is created with certain embodiments of the present invention.

Table 1. Interface Numbering Types Employed by Certain Embodiments of the Present Invention.

Numbering Type	Descriptions
Numbered	A) An IP address must be assigned to the interface. The IP address uniquely identifies the router interface (within that VPN domain). The network mask is /30 or /32 B) Interface Numbered with Broadcast: An IP address is assigned to the numbered interface, and the IP prefix length is in the range of /0 to /29. This interface is used for broadcasting to a Subnet.. For example an Interface is assigned the following broadcast address: IP address = (138.120.32.2) IP Network Mask = (255.255.255.0) Would result in an interface broadcasting to Subnet: 138.120.32/24
Unnumbered	No IP address is assigned to the interface.
Null, Loopback	These Interfaces are not valid IP link endpoints but can be visible by listing this Interface.

The link numbering selection of step 313 will not occur for point-to-subnet selection 309, as point-to-subnet interfaces must be numbered by default. If "unnumbered" is selected in step 314, the NMS sets the IP address and IP Netmask field to be invisible for the endpoints in step 316. If "numbered" is selected in step 315, the NMS sets the IP address and Netmask field to be visible for the endpoints in step 317. The supported link types for numbered and unnumbered interfaces according to at least one embodiment of the present invention are summarized and presented in Table 2.

Table 2. Supported Link Types for Numbered and Unnumbered Interfaces.

IP Link Type	IP Link Endpoint A	IP Link Endpoint B	Descriptions
Point-to-Point	Numbered Interface A	Numbered Interface B	Both Interfaces must be Numbered with a network mask of /30 or /32.
Point-to-Point	Unnumbered Interface A	Unnumbered Interface B	Both Interfaces must be Unnumbered
Point-to-IP	Numbered Interface A	IP address of neighbor Interface	Both Interfaces must be Numbered with a network mask or /30 or /32
Point-to-IP	Interface (Unnumbered)	IP address of neighbor Router	Both Interfaces must be Unnumbered.
Point-to-Subnet	Numbered Interface A with network mask of /0 to /29.	Subnet Address *(Note 1)*	Interface A IP Address must be numbered with a broadcast address. The Subnet address is derived from the interface A IP address.

Again referring to Figure 3A, the user selects the link application in step 319. The application options available are IP forwarding in step 321, IP forwarding and MPLS in step 323, or MPLS in step 324. If IP forwarding is selected in step 321, the NMS sets the Multi-Protocol Label Switching (MPLS) tab to not accessible in step 322. For IP forwarding in step 323 and MPLS selection in step 324, the NMS, in step 325, will disallow multiple hops as routers must be physically, directly connected. In addition, in step 325 the NMS will disallow any Path support configuration.

When an IP link is created, if the router interface does not exist, the NMS sub layer interface is used to create the router interface and the IP link. In step 327, the user selects the sub

layer interface type. To create an IP link, at least one sub layer interface endpoint (port/channel) is required. The sub layer interfaces supported on routers by certain embodiments of the present invention are shown in Table 3 for the appropriate routers.

Table 3. Sub Layer Interfaces Supported on Routers.

ATM VPI/VCI	POS Un-Channelized	POS Channelized	GigEthernet
Yes	Yes	Yes	Yes

From the data of Table 3, it is seen that the user can create an ATM IP link with an endpoint from/to: Router A to Router B. NMS managed router to unmanaged router is supported via "Point-to-IP." Also, the user can create a POS Un-Channelized IP link with an endpoint from/to: Router A to Router B. Further, the user can create a POS IP Link with an endpoint from/to: Router A to a Router B channelized. NMS managed router to unmanaged router is supported via "Point-to-IP." In addition, the user can create POS channelized IP link from/to: Router A to Router B, Router A Un-channelized to Router B. NMS Managed router to unmanaged router via "Point-to-IP." In addition, the user can create a GigEthernet IP link between: Router A to Router B. NMS managed router to unmanaged router is supported via "Point-to-IP" or "Point-to-Subnet."

The sub layer interface types available for the user to enable and which are supported by certain embodiments of the present invention are ATM in step 329, Packet Over Sonet (POS) in step 330, and GigEthernet in step 332, shown in Figure 3B and Table 3.1. Figure 3B is a continuation of the flowchart of Figure 3A. If ATM is selected in step 329, the NMS will set the "New" interface button to be visible on the GUI form, as in step 333. If either POS (step 330) or GigEthernet (step 332) is selected, the NMS system will set the "New" interface button to be invisible in step 335. Once the "New" interface button has been made visible in step 333, the user has the option in step 336 to create endpoint A or to paste an existing (already created) endpoint A. For the step 330 POS and step 332 GigEthernet options, only the paste endpoint option in step 337 would be available, as the "New" interface button was made invisible in step 335. Therefore, if pasting an existing endpoint A were chosen in step 337, the user performs a "List Interface" action from the NMS, selects the existing endpoint, and pastes the selection into the GUI form. Should the user wish to create a new endpoint A in step 336, in step 339 the user

would select the "New" interface button on the GUI form, which would launch the "Select Router" form. The user would then perform a "List Router" action, select the router, and paste the selected router into the "Select Router" form. As a final action in step 339, after selecting and pasting the router, the user would click (select) the "Ok" button, and the control is returned to the NMS IP link GUI form.

Table 3.1. Link Sublayer Interface Types Supported by Certain Embodiments of the Present Invention.

IP Link Type	Endpoint A Link Sublayer Interface Type	Endpoint B Link Sublayer Interface Type	IP Link Application
Point-to-Point	**ATM**	**ATM**	IP Forwarding: • Single hop supported • Multiple hops are supported with the NMS ATM VCC path as option. If a NMS path is included, then both endpoints of the path must be ATM and terminating on the router IP Link endpoints. MPLS & IP Forwarding, MPLS: • Single hop supported. When MPLS is enabled on the IP link, then only single hop is supported. NMS ATM VCC Path not supported.
Point-to-Point	**POS**	**POS**	IP Forwarding, MPLS & IP Forwarding, MPLS: • Single hop supported. *Note3*
Point-to-Point	**GigEthernet**	**GigEthernet**	IP Forwarding, MPLS & IP Forwarding, MPLS: • Single hop supported. *Note3*
Point-to-IP	**ATM**	**Not required** *(Note 1, Note2)*	IP Forwarding • Single hop supported • Multiple hops are supported with the NMS path as options. If a NMS ATM VCC path is included then one of the endpoints of the path must terminate on the endpoint A. The other path endpoint could be of any supported endpoint type (ATM, Frame Relay, etc). MPLS & IP Forwarding, MPLS: • Single hop supported. When MPLS is enabled on the IP link then only single hop is supported. NMS ATM VCC path not supported.
Point-to-IP	**POS**	**Not required** *(Note 1)*	IP Forwarding, MPLS & IP Forwarding, MPLS: • Single hop supported.

			Note3
Point-to-IP	GigEthernet	Not required *(Note 1)*	IP Forwarding, MPLS & IP Forwarding, MPLS: • Single hop supported. *Note3*
Point-to-Subnet	Any type	Not required *(Note 1)*	IP Forwarding, MPLS & IP Forwarding, MPLS: • Single hop supported and for Broadcast interfaces.

Note 1: For Point-to-IP and Point-to-Subnet the NMS user configures the IP Link Interface at Endpoint A only.
Note 2: The IP link interface endpoint B is not required but for the ATM VCC Path it is required. One of the ATM VCC path endpoints must be equal to IP link endpoint A and the other path endpoint is either a ATM or Frame Relay endpoint not terminating on a router.
Note 3: For interface on the Router A (where router A has limitations), only IP Link application "IP Forwarding & MPLS" is supported. IP Forwarding and MPLS cannot be individually turned off.
General Note: In order to provision the multiple-hops, the NMS path form is used. The number of hops used is determined automatically by the NMS Band Width Allocator (BWA).

Again referring to Figure 3B, in step 340 the choice of endpoint B depends upon the IP link type. For example, for point-to-subnet 345, the NMS user configures the interface at endpoint A only, as the numbered interface A must be numbered with a broadcast address and the subnet address is derived from the interface A IP address. The rules associated with IP link endpoints according to the present disclosure are presented in Table 4.

Table 4. IP Link Endpoints Rules.

IP Link Endpoint A & B Binding	B) Interface (Numbered)	B) Interface (Unnumbered)	B) Subnet	B) IP Address
A) Interface (Numbered)	√ Allowed if netmask of endpoint A is /30 or /32	Not allowed	√ Allowed if netmask of endpoint A is /0 to /29	√ (this is the IP address of neighbor Interface) Allowed if netmask of endpoint A is /30 or /32.
A) Interface (Unnumbered)	Not allowed	√	Not allowed	√ (this is the IP address of neighbor Router)

Thus if the point-to-point IP link type of step 341 applied, both ATM in step 342 and POS-GigEthernet in step 343 could be applicable. For point-to-IP in step 344, the user would enter the IP address of Endpoint B, as in step 349. For point-to-subnet in step 345, no endpoint B is required, as seen in step 350, for reasons previously discussed. Should the POS-GigEthernet of step 343 apply, endpoint B could be pasted in step 348 in the same fashion as was accomplished for endpoint A in step 337. If the ATM of step 342 applied, the user would have the option in step 346 of creating endpoint B, or pasting endpoint B. Should the user choose to create a new endpoint B as in step 347, the procedure would be accomplished in the same fashion as for endpoint A in step 339, or alternately, if the endpoint B already existed, it could be pasted in the same fashion in step 348 as was accomplished in step 337 for endpoint A.

Reference is now made to Figure 3C, the third page continuation of the flowchart illustrating a method for providing IP link creation for network management according to at least one embodiment of the present invention. Step 355 indicates that the information collected from the user during this session is used to populate the bottom form panels for GUI display. The information includes any pasted interface(s) information, if any were pasted in during the session. The user may choose to enter information into the General panel in step 357, if so desired. In step 359, the user enters the interface information. If the endpoint interfaces were pasted into the form (step 337 and/or step 348) instead of being created ("New"), then some of this information is derived from the endpoints, and the user can choose to modify the endpoint in step 359.

In the case of ATM only IP links, in step 360 the user enters the sub layer interface information. For the other endpoint types, the sub layer interface information is displayed only. Some of the ATM and/or other endpoint sub layer interface information is derived by the NMS from endpoint information previously pasted into the form during the session. If the IP link type supports multiple hops, in step 360 the user has the option of pasting in an existing ATM Path. This action is accomplished by the user selection of path listings, and then selecting the pasting the existing ATM Path into the GUI window. Additionally, the user has the option in step 360 to

create a path, if one does not already exist by selecting the "ATM VCC Path" button, which launches the path form. From the path form, the user creates a path, and the path is provisioned on the network. Once the path is created, the user may paste the path in the GUI window. Alternately, the user has the option in step 360 to specify no paths, if no paths are required.

For MPLS IP link types, in step 362 the user would enter the MPLS information. In the case of ATM only IP links, in step 364 the user enters the ATM Traffic parameters. If a Path was pasted in the sub layer panel, then this information is derived by the NMS from the previous action (steps 327 through 339). If no path was specified, the NMS defaults the path information to default values. The user has the option, however, to override the default values.

In step 366, the user clicks on the "Save" button on the form to begin the validation process for creating the IP link. Before anything is saved into the database, all rules and parameter ranges are verified. Nothing will be saved into the database if there is any verification failure, and will result in an error message being popped up stating the problem. In the various embodiments of the present invention, there are rules for validating the creation of an IP link in step 366. These rules are shown in Table 5.

Table 5. Rules for Validating the Creation of an IP Link.

1. Verify that the endpoints used by the IP Link are not already used by another IP links.
2. Verify Point-to-Point IP links that two interfaces (Endpoint A and Endpoint B) are provided when the interface exist, or that two Routers & the Sublayer interfaces are provided when the interfaces don't exist (user wishes to create the endpoints).
3. Verify Point-to-IP & Point-to-Subnet links that one interface (Endpoint A) is provided or that one Router & Sublayer interface is provided when the interface don't exist. (user wishes to create the endpoint).
4. Verify Point-to-IP links that the IP address (Endpoint B) is provided. The IP address could be one that already exist or a new IP Address.
5. Verify Point-to-Subnet links that the interfaces (Endpoint A) is provided with an IP address set with a mask of not all one's (for example, 255.255.255.255 is invalid). In other words the IP Address is providing the Subnet network address.
6. Verify that for numbered interfaces, an IP address and Network mask has been specified.
7. Verify that for numbered interfaces, the IP address specified is unique within the network being

managed.

8. Verify (Point-to-Point) that the interfaces used by the IP link have the same SubLayer type (ATM, POS, GigEthernet).
9. Verify (Point-to-Point) that the interfaces used by the IP link have the same application type (MPLS, IP Forwarding & MPLS, IP Forwarding)
10. Verify (Point-to-Point) that the interfaces used by the IP link have the same MTU.
11. Verify (Point-to-Point) that the interfaces used by the IP link have unique names.
12. Verify (Point-to-Point) that the interfaces used by the IP link have the same Bandwidth.
13. Verify (Point-to-Point) that the ATM interfaces used by the IP link have the same VPI/VCI at each end or is equal to the ATM Path VPI/VCI when a path is used.
14. Verify (Point-to-Point) that the interfaces used by the IP link have the same encapsulation (RFC1483 LCC/SNAP, RFC1483 Null Routed, PPP or Ethernet).
15. Verify (Point-to-Point) that the interfaces used by the MPLS IP link have same MPLS protocol (CR-LDP, RSVP-TE).
16. Verify (Point-to-Point) that the interfaces used by the MPLS IP link have same MPLS Label type (Generic, LC-ATM).
17. Verify (Point-to-Point) MPLS IP link are single hop.
18. Verify that the IP link endpoints matches the ATM Path endpoints when one is provided.
19. Verify (Point-to-Point) that All ATM traffic parameters match for both IP Link endpoints.
20. Verify that for some routers the MPLS link application is only "IP Forwarding & MPLS".
21. Verify that for some routers (compatibility) that the MPLS link uses is RSVP-TE protocol only.
22. Verify that for some routers that only one unnumbered IP link is created to another router. Until the router restriction is removed.
23. Verify that for some routers (restrictions) that they are only one MPLS signalling link per VPI.

Finally, when all the verifications (validations) have passed (step 360), in step 370 the network management system will send the configuration parameters are sent to the node (the network elements involved) via SNMP and saved into the database (if SNMP was successful), and the link status becomes "Link Down." If SNMP was not successful, the user is warned of the error. For some routers, CLI is used to send the information to the router. For CLI configuration the information is saved to the database and then sent down to the node. If the CLI command fails then it will log the error in the NMS ELS (Event Logging System) and the status of the IP link will reflect the failure. Creating the IP link will also create the Interface on the routers if they don't already exist. The Interfaces are created first and then the IP link.. If the IP link is not saved and the "Cancel" button is pressed, all the configurations will be lost. The IP Link status is changed to 'Link Down' until both Interface statuses are received from SNMP traps. When both Interfaces are up, the IP link status in the GUI window will change to 'Link Up.'

An IP Link can be created via the embodied NMS GUI manually, by SNMP IP Link trap for some routers, or by the auto-discovery process (per co-pending Application No._________"Method and Apparatus for Automatic Discovery of Logical Links between Network Devices"). An example of an IP link provisioning GUI window according to at least one embodiment of the present invention is shown in Figure 4, and generally designated example GUI window 400. GUI window 400 typifies what a user would see for provisioning a new point-to-point IP link by opening the New->Link->IP Link->Point-to-Point configuration form (not illustrated). A window title 405 appears at the top of the form to indicate the purpose of the window. The user may select the Link Numbering Type (Numbered or Unnumbered) with Link Numbering Type selection button 407. Link Numbering Type selection button 407 has "Numbered" selected in the example of Figure 4. The user may also select the Link Application (IP Forwarding, IP Forwarding and MPLS, or MPLS) with the Link Application selection button 408. In the same manner, the Link Sub layer Interface (ATM, POS, GigEthernet) may be selected with the Link Sub Layer Interface selection button 409.

For Interface Endpoint A, the user selects the New button 410 to launch the New Interface window (not illustrated). The New Interface window title is 'New Interface,' and contains only one field, "Router: => ________". The user must paste the router (to create the interface on) in the New Interface window. The router can be selected via the map feature, the navigator feature, or the list router window (not illustrated). Once the router is selected, the user clicks on the paste button to paste the router in the single field of the New Interface window, and then selects the OK button. The new interface is then created, and automatically filled in the Interface Endpoint A Paste field 411 of GUI provisioning window 400. In a similar manner, for Interface Endpoint B, the user selects the New button 412 to open the new Interface window (not illustrated), pastes router B and selects OK. The selected router is then automatically pasted into the Interface Endpoint B Paste field 413. The user selects the Interfaces panel tab 415 to access the Interface panel 414, and enters the IP address of the two numbered interfaces being created in the respective IP address field areas 417 and 418. The user would then select the Sublayer Interface panel tab 419 to access the Sublayer Interface panel (not illustrated) in order to paste in

the "two ATM Port" used by the IP link, and then select the save button. Upon clicking the save button, the IP Forwarding IP link would be created with two new Numbered Interfaces. Other tab panels available in GUI window 400 may include a general tab 424, an MPLS tab 420, and an ATM traffic parameters tab 422. By default, the general configuration tab panel is displayed when the IP link configuration form is opened.

In the various embodiments of the present invention, various fields are available within the various GUI forms. Table 6 indicates the various fields displayed on the New IP Link forms. In Table 6, the following column headings are used to describe the fields in the forms:

Panel Item Label: The name of a field in the form.

Visible: The user can or cannot see the field in the form. "Always" visible means the user can see the field. "Never" visible means the user cannot see the field.

Frozen: The field value is or is not editable. "Always" frozen means this field is not editable. "Never" frozen means this field is editable. The frozen field has the information if the item is configurable during the IP Link Configuration operation (Config Mode: means during IP link configuration)

Default Value: What is the default value for this field value.

Valid Options: What is the valid value that a user can enter in this field.

Affects On Other Fields: If changing the value of this field will affect the other fields.

When creating an IP link up as taught herein, three Objects are created: the two router Interfaces and the IP Link. When paste Interface is selected, the Interface is not created, but is used. When new Interface is selected, then the Interface is created.

Table 6. Fields Displayed on the New IP Link Form.

Panel Item Label	Visible	Frozen	Default Value	Valid Options	Affects On Other Fields/Comment.
IP Link Type is set when the window is	N/A	N/A	N/A	"Point-to-Point" "Point-to-IP" "Point-to-Subnet"	Select point-to-point if you want a 'point-to-point' IP link and you are managing

Panel Item Label	Visible	Frozen	Default Value	Valid Options	Affects On Other Fields/Comment.
opened. The IP link Type appears in the title of the window.					both routers. Select point-to-IP if you want a 'point-to-point' IP link and you are managing only one router. Select point-to-Subnet if you want to create a broadcast interface. For Point-to-Point the Endpoint A and Endpoint B field become visible with there default For Point-to-IP the endpoint B is the IP address. For Point-to-Subnet the Endpoint B is not visible.
Link Connection Type:	Always	Never frozen in New mode. Always frozen in Config mode	'Numbered".	"Numbered" "Unnumbered" for Point-to-Point and Point-to-IP. "Numbered" for Point-to-Subnet	Changing this field to "Numbered" will require an IP address and IP network mask to be filled in for the interface(s). Changing this field to Unnumbered will result in the IP address and network mask to be invisible and not required. The user can paste in a unnumbered interface even if this field is set to Numbered. On the save, the interface(s) will be changed to whatever the Link Connection Type is set too. See
Link Application	Always	Never frozen in New mode.	"IP Forwarding"	"MPLS & IP Forwarding", "IP Forwarding",	Select the type of application you want to run over the IP link. - "IP Forwarding"

Panel Item Label	Visible	Frozen	Default Value	Valid Options	Affects On Other Fields/Comment.
		Always frozen in Config Mode		"MPLS" (will turn ip forwarding off on forwarding interfaces, useful for LSP IP links on non-forwarding cards.)	is used for forwarding only. - "MPLS & IP Forwarding" is used for both. - "MPLS" is used only if you are creating a ATM IP link to a 7670 on non-forwarding cards. This option should not be used otherwise. When this field is set to "MPLS & IP Forwarding" or "MPLS" the MPLS panel is accessible MPLS only supports single hop so the Path field is frozen.
Link Sublayer Interface:	Always	Never frozen in New mode, but toggling between ATM, POS, GigEthernet will result in the fields being reset. Always frozen in Config Mode	"ATM",	ATM POS GigEthernet	Select the Interface type you want. <u>ATM:</u> When this field is set to 'ATM' the user can select New button or Paste for the interface. New is the default. The ATM Traffic Parameter panel is enabled. The Sub Layer Interface path field is available. <u>POS:</u> When this field is set to POS, the user cannot select new interface (the new button are greyed out), only paste interface is available since Interface are created when the card is inserted. The ATM Traffic Parameters panel is

Panel Item Label	Visible	Frozen	Default Value	Valid Options	Affects On Other Fields/Comment.
					frozen. The Sub layer Interface displays the POS parameters. GigEthernet When this field is set to 'GigEthernet' the user cannot select new interface, only paste interface is available. The ATM TP panel is frozen. The Sublayer displays the GigEthernet port.
New button for Endpoint A.	Always	Frozen in New mode when Link Sublayer is POS or GigEthernet Never frozen in New mode for ATM. Always frozen in config mode	N/A	N/A	For Endpoint A: When this button is pressed the new Interface window is opened. The user can paste in a router. When the users clicks ok the new Interface is entered in the paste field. The inteface created depends on the IP Link Numbering Type and Sublayer Interface field. The Endpoint A will be created on the save?
Paste for Endpoint A	Always	Frozen in New mode when IP link Sub layer is ATM. Never frozen in new mdoe for POS or GigEthernet. Always frozen in config mode	N/A	A valid Interface from the List Interface window or the new interface window.	For Endpoint A: The user can paste in a valid interface. The interface must be the same type as the IP Link Sublayer Interface field. Allow the user to paste numbered or unnumbered interface not matching the Connection type since on the save the type will be changed accordingly. The Interface endpoint is of the following format:

Panel Item Label	Visible	Frozen	Default Value	Valid Options	Affects On Other Fields/Comment.
					<RouterName/interface> Example: Toronto/ 0001 No IP link must exist on the paste in Interface.
New for endpoint B	Only visible when the Link Type is Point-to-Point Not visible otherwise.	Frozen in New mode when Link Sublayer is POS or GigEthernet. Never frozen in New mode for ATM. Always frozen in config mode	N/A	N/A	For Endpoint B: When this button is pressed the new Interface window is opened. The user can paste in a router. When the users clicks ok the new Interface is entered in the paste field. The interface created depends on the IP Link Connection Type and Sublayer Interface field. The Endpoint B will be created on the save.
Paste for endpoint B	Visible when the Type is Point-to-Point.	Frozen in New mode when IP link Sub layer is ATM. Never frozen in New mode for POS or GigEthernet. Always frozen in config mode	N/A	A valid Interface from the List Interface window or the new interface window.	For Endpoint B: The user can paste in a valid interface. The interface must be the same type as the IP Link Sublayer Interface field. Allow the user to paste numbered or unnumbered interface not matching the Connection type since on the save the type will be changed accordingly. No IP link must exist on the paste in Interface.
IP Address Endpoint B:	Only visible when Type is Point-to-IP	Never frozen in New mode. Always frozen in config mode	0.0.0.0	Ipv4	For Endpoint B: For Link Connection Type Numbered the field is the IP address of the neighbor router interface. For Link Connection Type Unnumbered

Panel Item Label	Visible	Frozen	Default Value	Valid Options	Affects On Other Fields/Comment.
					this field is the IP Address of the neighbor Router.(The Router ID of the neighbor router which is an IP address).

In addition to creating an end-to-end IP link with an embodiment of the present invention, it is possible for a user to delete an Interface with the embodied NMS GUI, as well as the CLI or the EM application. Certain interfaces such as POS and GigEthernet are not deleted on a delete action but actually return to the default configuration, which is an unnumbered interface. The interface is deleted from the disclosed logical link database when any of the following actions occur:

- The user selects the Interface (via the List Interface window) and performs Object->Delete. The interface can only be deleted if no IP Link exists on the interface. If the interface is POS or GigEthernet, then this action is not permitted.
- The user deletes an IP Link by selecting it in the List IP link window and performing Object->Delete.
- The card is deleted, in the case of POS and GigEthernet interfaces.
- The router is reconciled and the Interface is determined to no longer exist.
- The router is deleted. In this case, the Interface is deleted within the logical link database, but is not deleted on the network.
- The SNMP trap is received indicating an Interface was deleted on the node.

When the user deletes an IP Link "Point-to-Subnet," the subnet is deleted if it is the last IP link using the subnet.

Figure 5 is a flow diagram illustrating a method for provisioning logical configuration links for network devices in accordance with an embodiment of the invention. The method may be used, for example, for provisioning logical configuration links for at least two network devices through a dedicated graphical user interface form. In step 501, a network device having

at least one network interface is selected through the dedicated graphical user interface form. In step 502, local interface and next neighbor information for the network device is determined. In step 503, a determination is made as to whether or not the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database. If so, the process continues at step 509. If not, the process continues at step 504.

In step 504, a new logical configuration link is created. In step 505, the new logical configuration link is stored in the logical link database. In step 506, the new logical configuration link is validated. In step 507, the new logical configuration link is sent to the network device. In step 508, a graphical representation of the new logical configuration link is displayed on a display device.

In step 509, a logical configuration link in the logical link database is modified. In step 510, a logical configuration link in the logical database is deleted.

Figure 6 is a flow diagram illustrating a process for creating a new logical configuration link in accordance with an embodiment of the present invention. As an example, step 504 of Figure 5 may comprise one or more of the steps illustrated in Figure 6. In step 601, a link type is selected. Step 601 may comprise step 602. In step 602, the link type is selected from among a group consisting of: point-to-point, point-to-IP, and point-to-subnet. In step 603, a link numbering type is selected for the new logical configuration link. Step 603 may comprise step 604. In step 604, the link numbering type is selected from a group consisting of: a numbered type and an unnumbered type. In step 605, a link application is selected for the new logical configuration link. Step 605 may comprise step 606. In step 606, the link application is selected from a group consisting of: Internet Protocol Forwarding, Multi-Protocol Label Switching and Internet Protocol Forwarding, or Multi-Protocol Label Switching. In step 607, a sub layer interface type is selected. Step 607 may comprise step 608. In step 608, the sub layer interface type is selected from a group consisting of: Packet Over Sonet, Asynchronous Transfer Mode,

and GigEthernet. In step 609, a first endpoint is created for the new logical configuration link. In step 610, a second endpoint is created for the new logical configuration link.

Figure 7 is a block diagram illustrating apparatus for provisioning logical configuration links in accordance with an embodiment of the present invention. Display device 701 comprises graphical user interface 702. Graphical user interface 702 comprises graphical representation 703. Display device 701 is coupled to processing system 704. Processing system 704 is coupled to logical link database 705. Processing system 704 and logical link database 705 are coupled to network system 706. Network system 706 is coupled to network devices 707, 708, and 709. The illustrated couplings serve as an example; various elements may be coupled in various ways. Also, the illustrated elements may represent more complex configurations of components. For example, network devices 707-709 and/or network system 706 may include more complex configurations, such as that illustrated in Figure 1.

Logical link database 705 stores logical configuration links. Processing system 704 accesses the logical link database 705. Display device 701 provides the ability to select a network device having at least one network interface through graphical user interface 702. Processing system 704 determines local interface and next neighbor information for a network device, such as a network device 707-709 selected through graphical user interface 702. Processing system 704 determines whether the local interface and next neighbor information is associated with one of the logical configuration links stored in the logical link database 705. When the local interface and next neighbor information is not associated with any of the logical configuration links stored in the logical link database, processing system 704 creates a new logical configuration link.

Processing system 704 causes the new logical configuration link to be stored in the logical link database 705. Processing system 704 validates the new logical configuration link. Processing system 704 causes the new logical configuration link to be sent to the network device 707-709 to which it corresponds.

The various functions and components in the present application may be implemented using an information-handling machine such as a data processor, or a plurality of processing devices. Such a data processor may be a microprocessor, microcontroller, microcomputer, digital signal processor, state machine, logic circuitry, and/or any device that manipulates digital information based on operational instruction, or in a predefined manner. Generally, the various functions, and systems represented by block diagrams are readily implemented by one of ordinary skill in the art using one or more of the implementation techniques listed herein.

When a data processor for issuing instructions is used, the instruction may be stored in memory. Such a memory may be a single memory device or a plurality of memory devices. Such a memory device may be a read-only memory device, random access memory device, magnetic tape memory, floppy disk memory, hard drive memory, external tape, and/or any device that stores digital information. Note that when the data processor implements one or more of its functions via a state machine or logic circuitry, the memory storing the corresponding instructions may be embedded within the circuitry that includes a state machine and/or logic circuitry, or it may be unnecessary because the function is performed using combinational logic.

The method and apparatus herein provides for a flexible implementation. Although the invention has been described using certain specific examples, it will be apparent to those skilled in the art that the invention is not limited to these few examples. For example, the disclosure is discussed herein primarily with regard to provisioning network devices having IP and MPLS forwarding capabilities, the invention is applicable to network devices having forwarding capabilities using other protocols as well. Additionally, various types of routers and line cards are currently available which could be suitable for use in employing the method as taught herein. Note also, that although an embodiment of the present invention has been shown and described in detail herein, along with certain variants thereof, many other varied embodiments that incorporate the teachings of the invention may be easily constructed by those skilled in the art. Benefits, other advantages, and solutions to problems have been described above with regard to specific embodiments. However, the benefits, advantages, solutions to problems, and any

element(s) that may cause any benefit, advantage, or solution to occur or become more pronounced are not to be construed as a critical, required, or essential feature or element of any or all the claims. Accordingly, the present invention is not intended to be limited to the specific form set forth herein, but on the contrary, it is intended to cover such alternatives, modifications, and equivalents, as can be reasonably included within the spirit and scope of the invention.

WHAT IS CLAIMED IS:

1. A network administration method for provisioning logical configuration links for at least two network devices through a dedicated graphical user interface form, the method comprising:

selecting a network device having at least one network interface through the dedicated graphical user interface form;

determining local interface and next neighbor information for the network device;

determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database;

creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database;

storing the new logical configuration link in the logical link database;

validating the new logical configuration link;

sending the new logical configuration link to the network device; and

displaying a graphical representation of the new logical configuration link on a display device.

2. The method of claim 1, wherein the step of creating a new logical configuration link further comprises the steps of:

selecting a link type;

selecting a link numbering type for the new logical configuration link;

selecting a link application for the new logical configuration link;

selecting a sub layer interface type for the new logical configuration link;

creating a first endpoint for the new logical configuration link; and

creating a second endpoint for the new logical configuration link.

3. The method of claim 2, wherein the step of selecting the link type further comprises the step of:

selecting the link type from among a group consisting of: point-to-point, point-to-IP, and point-to-subnet.

4. The method of claim 2, wherein the step of selecting a link numbering type further comprises the step of:

selecting the link numbering type from a group consisting of: a numbered type and an unnumbered type.

5. The method of claim 2, wherein the step of selecting a link application further comprises the step of:

selecting the link application from a group consisting of: Internet Protocol Forwarding, Multi-Protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching.

6. The method of claim 2, wherein the step of selecting a sub layer interface type further comprises the step of:

selecting the sub layer interface type from a group consisting of: Packet Over Sonet, Asynchronous Transfer Mode, and GigEthernet.

7. The method of claim 1, further comprising the step of:

modifying a logical configuration link in the logical link database.

8. The method of claim 1, further comprising the step of:

deleting a logical configuration link in the logical link database.

9. Apparatus for provisioning logical configuration links comprising:

a logical link database for storing logical configuration links;

a processing system coupled to the logical link database for accessing the logical link database; and

a display device coupled to the processing system for displaying a graphical user interface form comprising a graphical representation of a logical configuration link.

10. The apparatus of claim 9 wherein the display device provides an ability to select a network device having at least one network interface through the graphical user interface form.

11. The apparatus of claim 9 wherein the processing system determines local interface and next neighbor information for the network device.

12. The apparatus of claim 11 wherein the processing system determines whether the local interface and next neighbor information is associated with one of the logical configuration links stored in the logical link database.

13. The apparatus of claim 12 wherein the processing system creates a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links stored in the logical link database.

14. The apparatus of claim 13 wherein the processing system causes the new logical configuration link to be stored in the logical link database.

15. The apparatus of claim 14 wherein the processing system validates the new logical configuration link.

16. The apparatus of claim 15 wherein the processing system causes the new logical configuration link to be sent to the network device.

METHOD AND SYSTEM FOR IP LINK MANAGEMENT

ABSTRACT OF THE DISCLOSURE

An embodiment of the present invention provides a method for network management that allows the configuration of IP links in one step, via a GUI form, even though the management protocols available at the two end links (routers) may differ. According to one embodiment, the method comprises gathering information from the user, validating this information, and then sending this information to the appropriate router(s). According to one embodiment, the method enables a user to specify various configurations when provisioning an IP link, for example, the type of IP link (Point-to-Point, Point-to-IP, or Point-to-Subnet), the numbering type (Numbered or Unnumbered), the application type (MPLS and/or IP Forwarding), and the sub-layer interfaces to be used (Packet Over Sonet, Asynchronous Transfer Mode, GigEthernet, and others). In addition, according to one embodiment, the method allows the IP link to be associated to existing router interface(s), or the interfaces can be created as part of the IP link creation process.

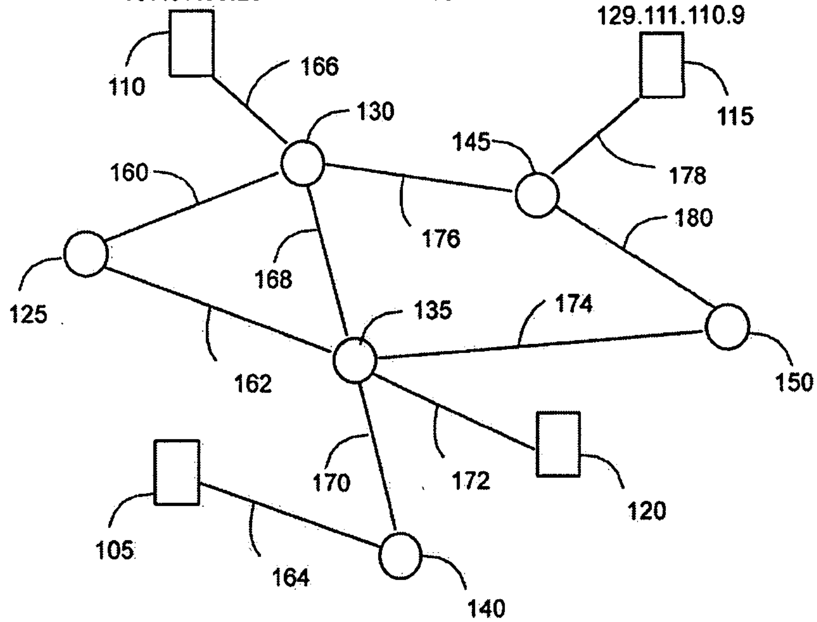


Figure 1

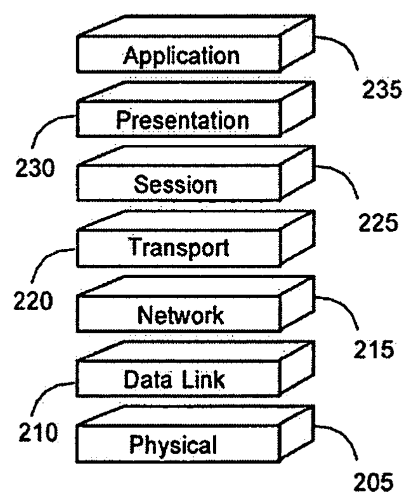


Figure 2

IP Link Creation Flow Chart:

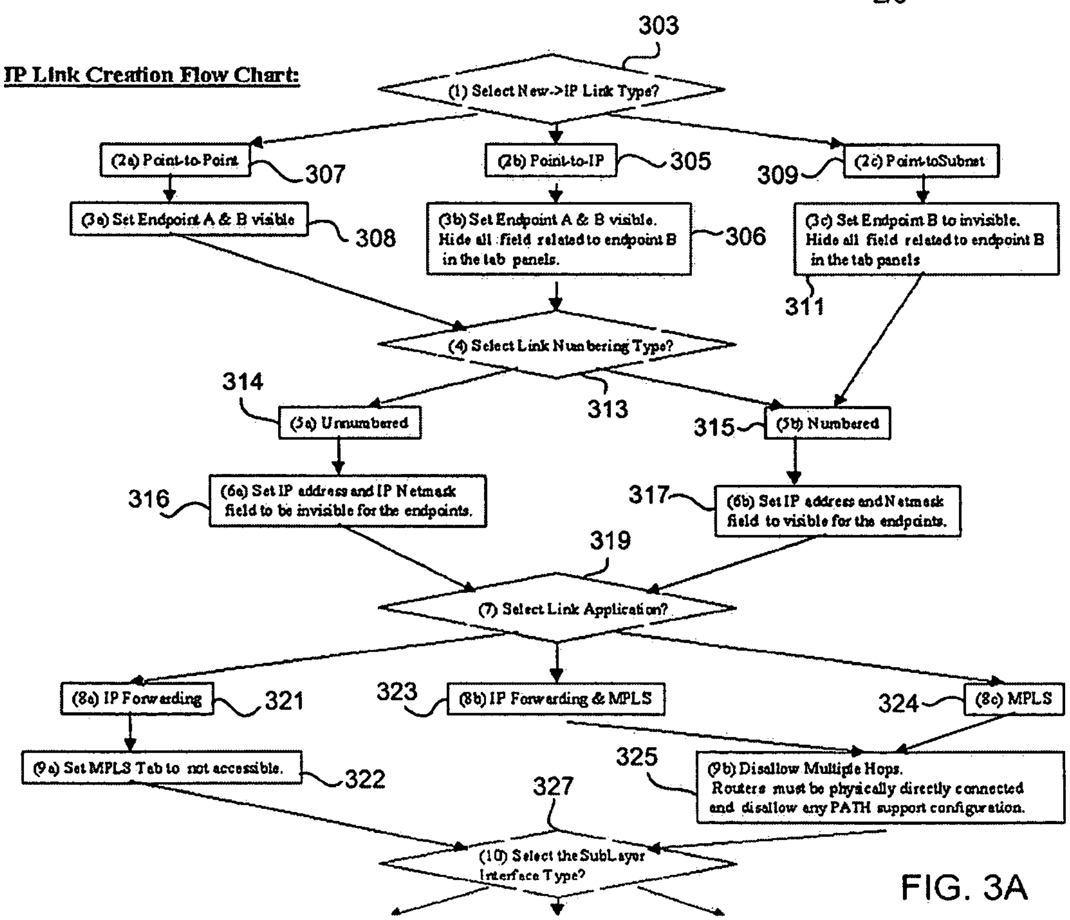


FIG. 3A

10061251 . 128/2001

3/8

FIG. 3B

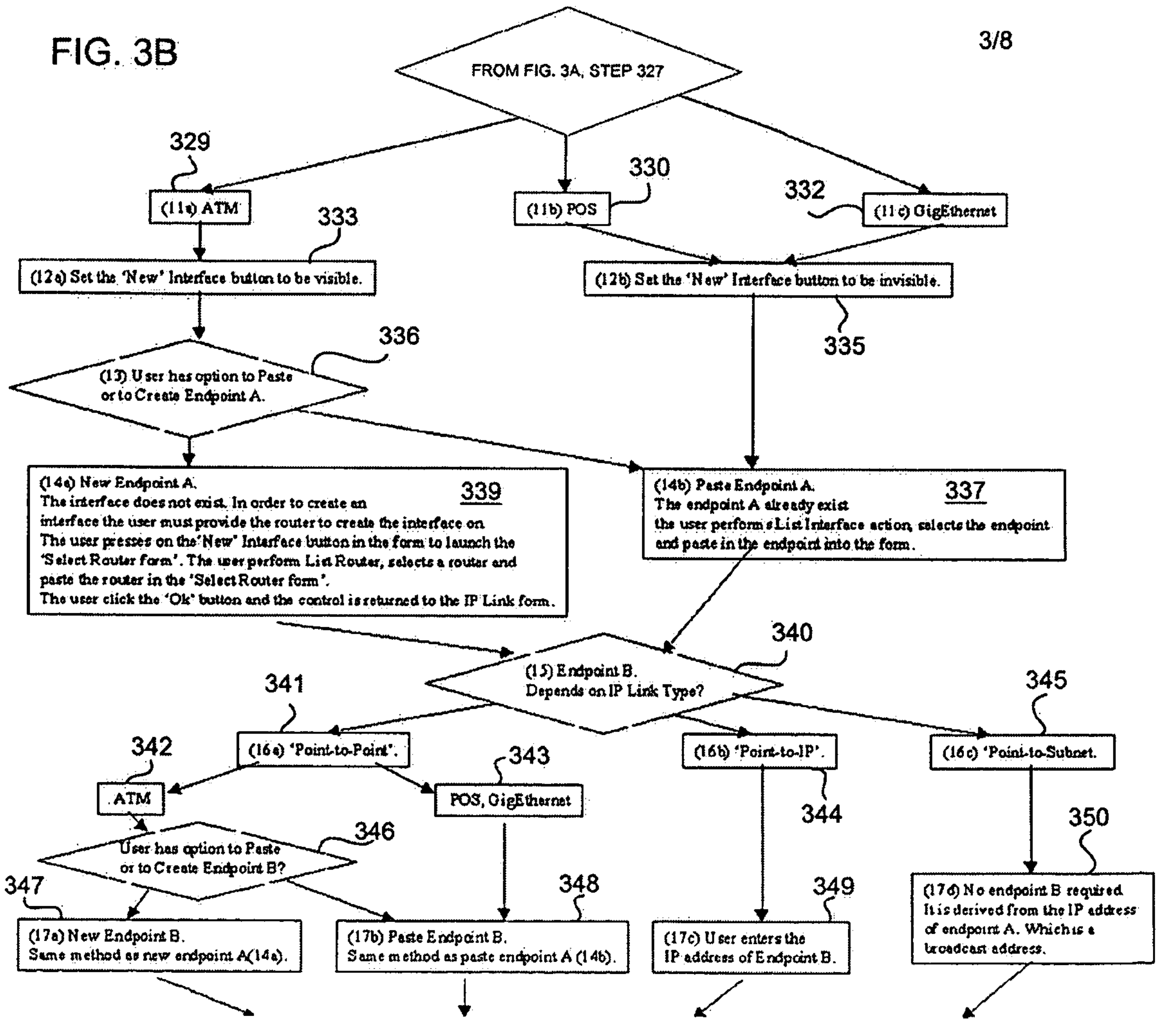
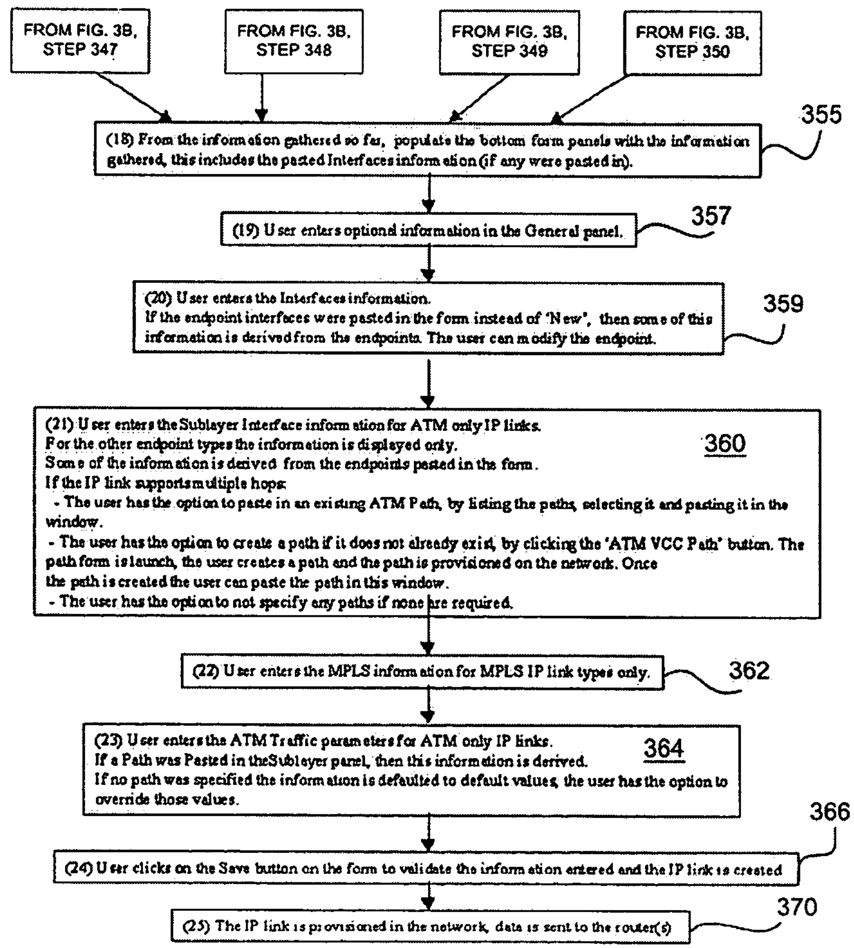


FIG. 3C


FROM FIG. 3B, STEP 347
FROM FIG. 3B, STEP 348
FROM FIG. 3B, STEP 349
FROM FIG. 3B, STEP 350
(18) From the information gathered so far, populate the bottom form panels with the information gathered, this includes the pasted Interfaces information (if any were pasted in).
355
(19) User enters optional information in the General panel.
357
(20) User enters the Interfaces information.
If the endpoint interfaces were pasted in the form instead of 'New', then some of this information is derived from the endpoints. The user can modify the endpoint.
359
(21) User enters the Sublayer Interface information for ATM only IP links.
For the other endpoint types the information is displayed only.
Some of the information is derived from the endpoints pasted in the form.
If the IP link supports multiple hops:
- The user has the option to paste in an existing ATM Path, by listing the paths, selecting it and pasting it in the window.
- The user has the option to create a path if it does not already exist, by clicking the 'ATM VCC Path' button. The path form is launch, the user creates a path and the path is provisioned on the network. Once the path is created the user can paste the path in this window.
- The user has the option to not specify any paths if none are required.
360
(22) User enters the MPLS information for MPLS IP link types only.
362
(23) User enters the ATM Traffic parameters for ATM only IP links.
If a Path was Pasted in the Sublayer panel, then this information is derived.
If no path was specified the information is defaulted to default values, the user has the option to override those values.
364
(24) User clicks on the Save button on the form to validate the information entered and the IP link is created
366
(25) The IP link is provisioned in the network, data is sent to the router(s)
370

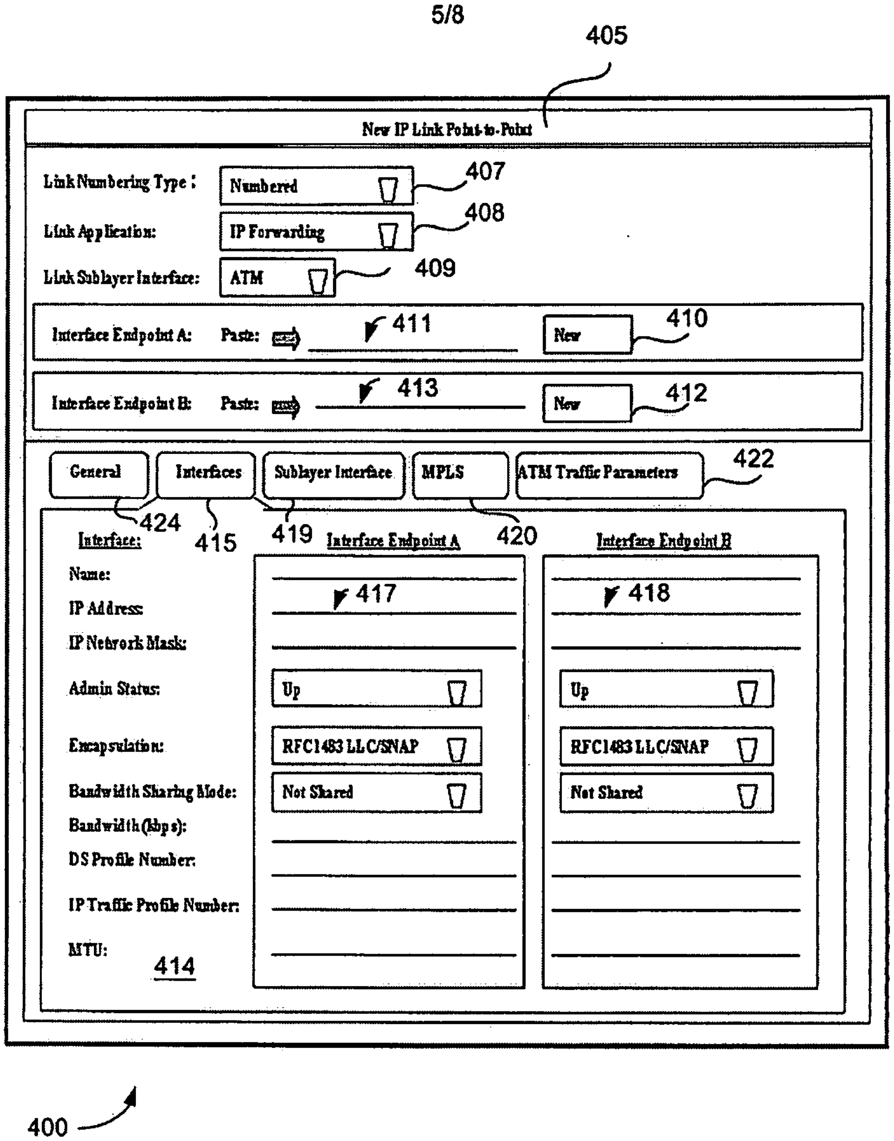

405
New IP Link Point-to-Point
Link Numbering Type:
Numbered
407
Link Application:
IP Forwarding
408
Link Sublayer Interface:
ATM
409
Interface Endpoint A:
Paste:
411
New
410
Interface Endpoint B:
Paste:
413
New
412
General
Interfaces
Sublayer Interface
MPLS
ATM Traffic Parameters
422
424
415
419
420
Interface:
Interface Endpoint A
Interface Endpoint B
Name:
IP Address:
417
418
IP Network Mask:
Admin Status:
Up
Up
Encapsulation:
RFC1483 LLC/SNAP
RFC1483 LLC/SNAP
Bandwidth Sharing Mode:
Not Shared
Not Shared
Bandwidth (kbps):
DS Profile Number:
IP Traffic Profile Number:
MTU:
414
400

FIG. 4

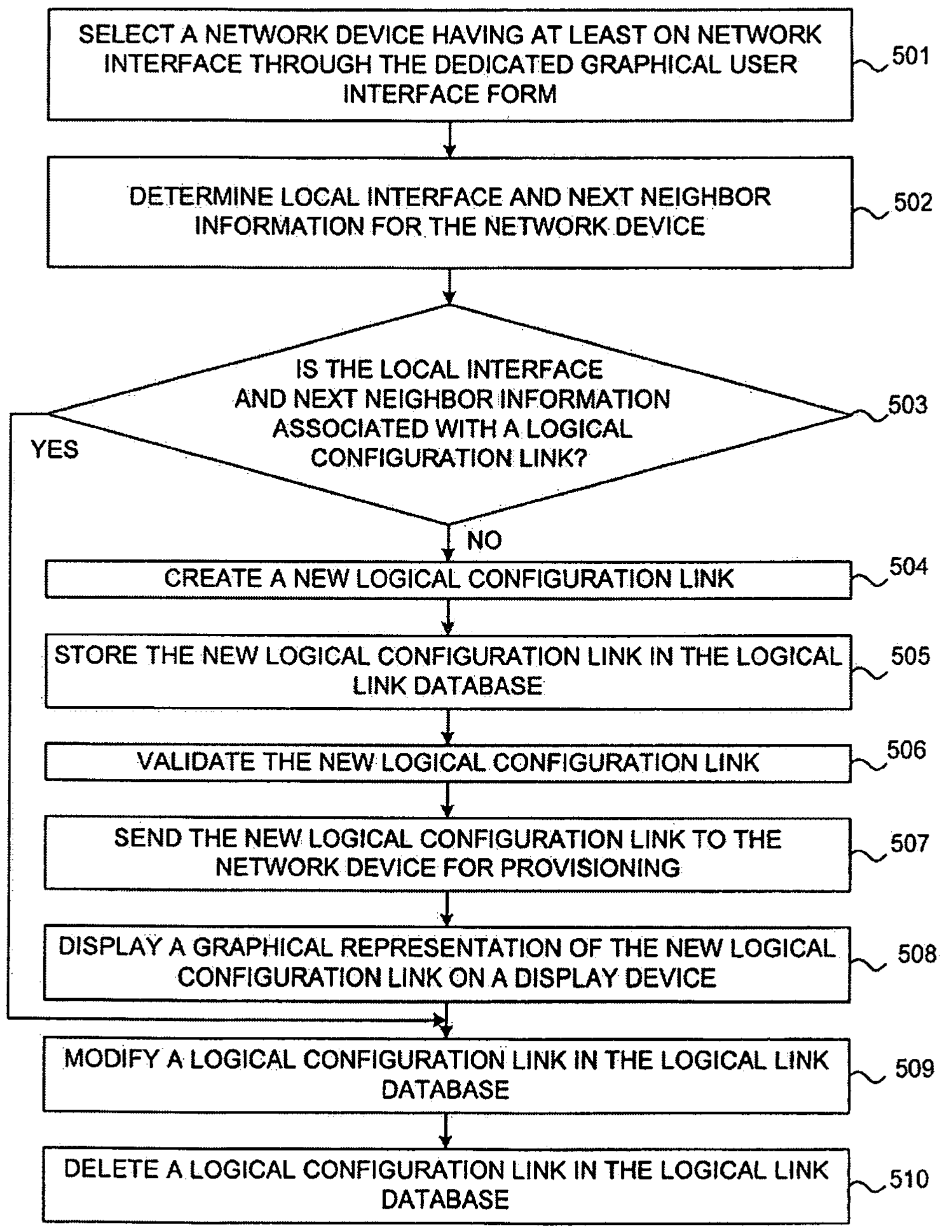

SELECT A NETWORK DEVICE HAVING AT LEAST ON NETWORK INTERFACE THROUGH THE DEDICATED GRAPHICAL USER INTERFACE FORM
501
DETERMINE LOCAL INTERFACE AND NEXT NEIGHBOR INFORMATION FOR THE NETWORK DEVICE
502
IS THE LOCAL INTERFACE AND NEXT NEIGHBOR INFORMATION ASSOCIATED WITH A LOGICAL CONFIGURATION LINK?
503
YES
NO
CREATE A NEW LOGICAL CONFIGURATION LINK
504
STORE THE NEW LOGICAL CONFIGURATION LINK IN THE LOGICAL LINK DATABASE
505
VALIDATE THE NEW LOGICAL CONFIGURATION LINK
506
SEND THE NEW LOGICAL CONFIGURATION LINK TO THE NETWORK DEVICE FOR PROVISIONING
507
DISPLAY A GRAPHICAL REPRESENTATION OF THE NEW LOGICAL CONFIGURATION LINK ON A DISPLAY DEVICE
508
MODIFY A LOGICAL CONFIGURATION LINK IN THE LOGICAL LINK DATABASE
509
DELETE A LOGICAL CONFIGURATION LINK IN THE LOGICAL LINK DATABASE
510

FIG. 5

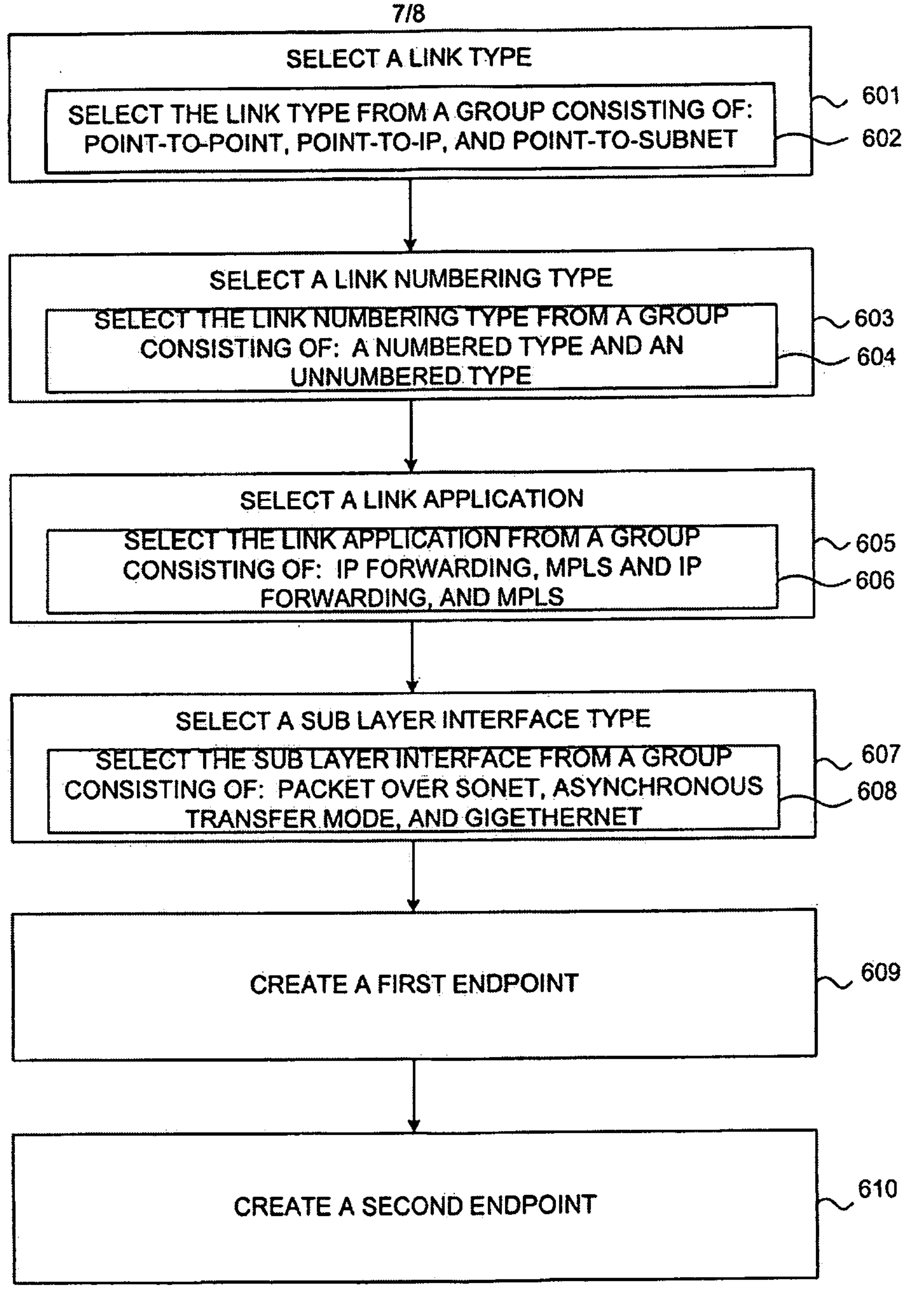

SELECT A LINK TYPE
SELECT THE LINK TYPE FROM A GROUP CONSISTING OF: POINT-TO-POINT, POINT-TO-IP, AND POINT-TO-SUBNET
601
602
SELECT A LINK NUMBERING TYPE
SELECT THE LINK NUMBERING TYPE FROM A GROUP CONSISTING OF: A NUMBERED TYPE AND AN UNNUMBERED TYPE
603
604
SELECT A LINK APPLICATION
SELECT THE LINK APPLICATION FROM A GROUP CONSISTING OF: IP FORWARDING, MPLS AND IP FORWARDING, AND MPLS
605
606
SELECT A SUB LAYER INTERFACE TYPE
SELECT THE SUB LAYER INTERFACE FROM A GROUP CONSISTING OF: PACKET OVER SONET, ASYNCHRONOUS TRANSFER MODE, AND GIGETHERNET
607
608
CREATE A FIRST ENDPOINT
609
CREATE A SECOND ENDPOINT
610

FIG. 6

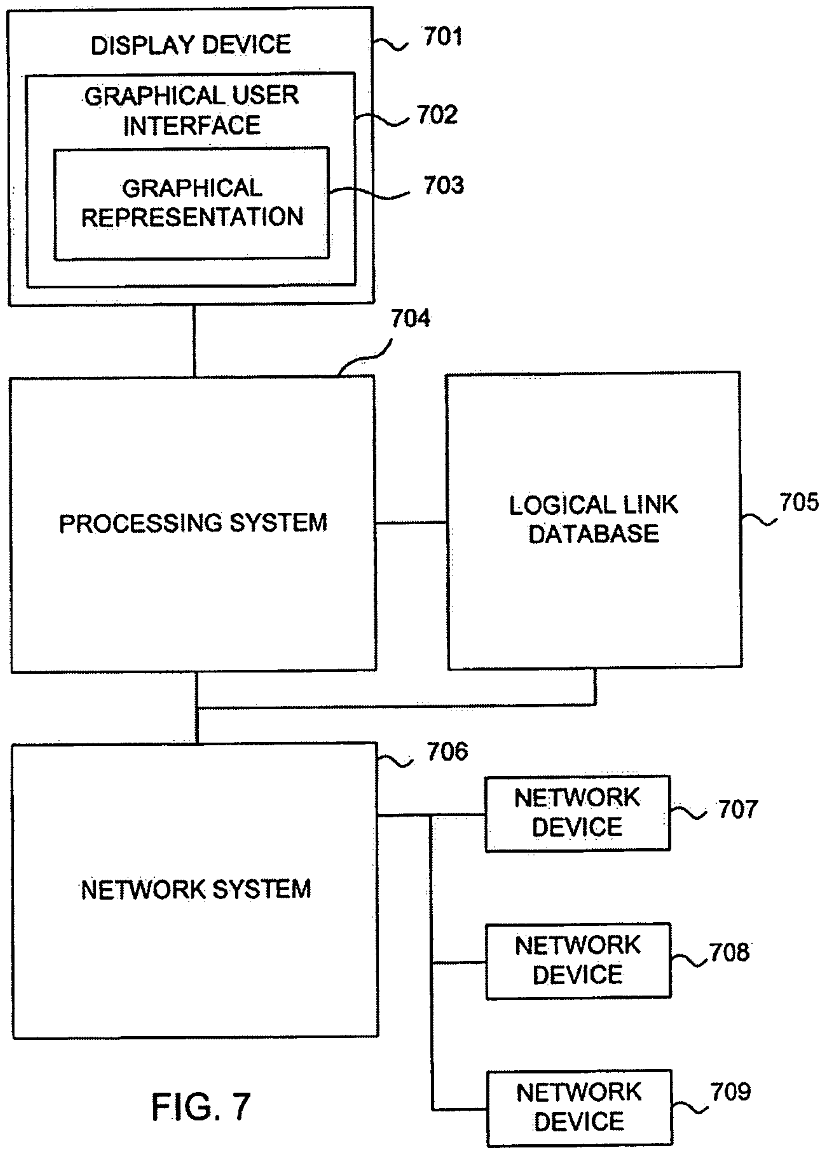

DISPLAY DEVICE
701
GRAPHICAL USER INTERFACE
702
GRAPHICAL REPRESENTATION
703
704
PROCESSING SYSTEM
LOGICAL LINK DATABASE
705
706
NETWORK SYSTEM
NETWORK DEVICE
707
NETWORK DEVICE
708
NETWORK DEVICE
709

FIG. 7

UNITED STATES PATENT AND TRADEMARK OFFICE

COMMISSIONER FOR PATENTS
UNITED STATES PATENT AND TRADEMARK OFFICE
WASHINGTON, D.C. 20231
www.uspto.gov

APPLICATION NUMBER	FILING/RECEIPT DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
10/027,821	12/19/2001	Denis Proulx	1400.1374890

CONFIRMATION NO. 9507

FORMALITIES LETTER

OC000000007386887

25697
ROSS D. SNYDER & ASSOCIATES, INC.
115 WILO BASIN RD.
SUITE 107
AUSTIN, TX 78746

Date Mailed: 01/29/2002

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
  Applicant must submit $ **740** *to complete the basic filing fee for a non-small entity. If appropriate, applicant may make a written assertion of entitlement to small entity status and pay the small entity filing fee (37 CFR 1.27).*
- The oath or declaration is missing.
  A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.
- To avoid abandonment, a late filing fee or oath or declaration surcharge as set forth in 37 CFR 1.16(l) of $130 for a non-small entity, must be submitted with the missing items identified in this letter.
- **The balance due by applicant is $ 870.**

A copy of this notice <u>MUST</u> be returned with the reply.

Customer Service Center
Initial Patent Examination Division (703) 308-1202
PART 3 - OFFICE COPY

OIPE JC174 MAY 0 9 2002 PATENT & TRADEMARK OFFICE

PATENT APPLICATION

#3

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Proulx, et al.

Title: METHOD AND SYSTEM FOR IP LINK MANAGEMENT

App. No.: 10/027,821 Filed: 12-19-2001

Examiner: Unknown Group Art Unit: 2673

COPY OF PAPERS ORIGINALLY FILED

Atty. Dkt. No. 1400.1374890

Attention: Box Missing Parts
Honorable Commissioner of
Patents and Trademarks
Washington, D.C. 20231

RESPONSE TO NOTICE TO FILE MISSING PARTS OF APPLICATION

Dear Sir:

In response to the Notice to File Missing Parts of Application mailed January 29, 2002, please find enclosed herewith:

- ☒ a Transmittal Form;
- ☒ a copy of the Notice to File Missing Parts of Application;
- ☒ a Fee Transmittal Form w/Fee attached (checks # 1416 and 1427);
- ☒ a Combined Declaration and Power of Attorney executed on behalf of Alcatel Canada Inc.;
- ☒ an Assignment to Alcatel Canada Inc. with Recordation Form Cover Sheet;
- ☒ a Petition for Extension of Time; and
- ☒ a Return Receipt Postcard.

Respectfully submitted,

April 30, 2002
Date

Ross D. Snyder, Reg. No. 37,730
Attorney for Applicant(s)
Ross D. Snyder & Associates, Inc.
115 Wild Basin Road, Suite 107
Austin, Texas 78746
(512) 347-9223 (phone)
(512) 347-9224 (fax)

#3
MP

OIPE JC174
MAY 0 9 2002
PATENT & TRADEMARK OFFICE

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Total Number of Pages in this Submission 12

Application Number: 10/027,821
Filing Date: 12-19-2001
First Named Inventor: Proulx, et al.
Group Art Unit: 2673
Examiner: Unknown
Attorney Docket No.: 1400.1374890

ENCLOSURES (check all that apply)

COPY OF PAPERS ORIGINALLY FILED

- ☒ Fee Transmittal Form
  - ☒ Fee Attached
- ☐ Amendment/Response
- ☐ After Final
- ☐ Affidavits/Declaration(s)
- ☒ Extension of Time Request
- ☐ Express Abandonment Request
- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Response to Missing Parts/Incomplete Application
- ☒ Response to Missing Parts under 37 CFR 1.52 or 1.53
- ☒ Assignment Papers (for an Application)
- ☐ Drawing(s)
- ☐ Licensing-related Papers
- ☐ Petition Routing Slip (PTO/SB/69) and Accompanying Petition
- ☐ To Convert a Provisional Application
- ☒ Power of Attorney, Revocation, Change of Correspondence Address
- ☐ Terminal Disclaimer
- ☐ Small Entity Statement
- ☐ Request for Refund
- ☐ After Allowance Communication to Group
- ☐ Appeal Communication to Group (Appeal Notice, Brief, Reply Brief)
- ☐ Proprietary Information
- ☐ Status Letter
- ☐ Request for Corrected Filing Receipt
- ☐ Letter to Draftsperson
- ☐ Formal Drawings (after initial filing)
- ☐ Issue Fee Transmittal
- ☐ Request for Corrected Assignment
- ☐ Additional Enclosure(s) (please identify below):

Remarks:

Firm Name	Ross D. Snyder & Associates, Inc. 115 Wild Basin Road, Suite 107 Austin, Texas 78746	
Signature of Applicant, Attorney, or Agent	Ross D. Snyder	
Name and Registration No.:	Ross D. Snyder, Reg. No. 37,730	Date: 04/30/02

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to Assistant Commissioner for Patents, Washington, D.C. 20231 on: April 30, 2002

Ross D. Snyder
Typed or Printed Name

Ross D. Snyder Reg. No. 37,730
Signature

OIPE JC174 MAY 0 9 2002 PATENT & TRADEMARK OFFICE

FEE TRANSMITTAL for FY 2001

Patent fees are subject to annual revision.

TOTAL AMOUNT OF PAYMENT ($) 1310.00

Complete if Known

Application Number	10/027,821
Filing Date	12-19-2001
First Named Inventor	Proulx, et al.
Group Art Unit	2673
Examiner Name	Unknown
Attorney Docket Number	1400.1374890

METHOD OF PAYMENT (check one)

1. ☒ The Commissioner is hereby authorized to charge indicated fees and credit any over payments to:

Deposit Account Number	50-1566
Deposit Account Name	Ross D. Snyder & Associates, Inc.

☒ Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17

☐ Charge the Issue Fee Set in 37 CFR 1.18 at the mailing of the Notice of Allowance

☐ Applicant claims small entity status. See 37 CFR 1.27

2. ☒ Payment Enclosed:

☒ Check ☐ Money Order ☐ Other

FEE CALCULATION

1. FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
101	740	201	370	Utility filing fee	740.00
106	330	206	165	Design filing fee	
107	510	207	255	Plant filing fee	
108	740	208	370	Reissue filing fee	
114	160	214	80	Provisional filing fee	

SUBTOTAL (1) ($) 740.00

2. CLAIMS

Claims	Extra	Fee from below	Fee Paid
Total 16	(-20 =) 0		
Indep. 2	(-3 =) 0		
Multiple Dep.			

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
103	18	203	9	Claims in excess of 20
102	84	202	42	Independent claims in excess of 3
104	280	204	140	Multiple dependent claim
109	84	209	42	Reissue independent claims over original patent
110	18	210	9	Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) ______

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
105	130	205	65	Surcharge - late filing fee or oath	130.00
127	50	227	25	Surcharge - late provisional filing fee or cover sheet.	
139	130	139	130	Non-English specification	
147	2,520	147	2,520	For filing a request for reexamination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within first month	
116	400	216	200	Extension for reply within second month	400.00
117	920	217	460	Extension for reply within third month	
118	1,440	218	720	Extension for reply within fourth month	
128	1,960	228	980	Extension for reply within fifth month	
119	320	219	160	Notice of Appeal	
120	320	220	160	Filing a brief in support of an appeal	
121	280	221	140	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive - unavoidable	
141	1,280	241	640	Petition to revive - unintentional	
142	1,280	242	640	Utility issue fee (or reissue)	
143	460	243	230	Design issue fee	
144	620	244	310	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Petitions related to provisional applications	
126	180	126	180	Submission of Information Disclosure Stmt	
581	40	581	40	Recording each patent assignment per property (times number of properties)	40.00
146	740	246	370	Filing a submission after final rejection (37 CFR 1.129(a))	
149	740	249	370	For each additional invention to be examined (37 CFR 1.129(b))	
Other fee (specify)					
Other fee (specify)					

*Reduced by Basic Filing Fee Paid SUBTOTAL (3) ($) 570.00

SUBMITTED BY ROSS D. SNYDER & ASSOCIATES, INC.			Complete (if applicable)	
Typed or Printed Name	Ross D. Snyder, Reg. No. 37,730			
Signature	Ross D. Snyder	Date 04/30/02	Deposit Account User ID	

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ORIGINALLY FILED

#3

UNITED STATES PATENT AND TRADEMARK OFFICE

COMMISSIONER FOR PATENTS
UNITED STATES PATENT AND TRADEMARK OFFICE
WASHINGTON, D.C. 20231
www.uspto.gov

APPLICATION NUMBER	FILING/RECEIPT DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
10/027,821	12/19/2001	Denis Proulx	1400.1374890

CONFIRMATION NO. 9507

FORMALITIES LETTER

OC000000007386887

25697
ROSS D. SNYDER & ASSOCIATES, INC.
115 WILO BASIN RD.
SUITE 107
AUSTIN, TX 78746

Date Mailed: 01/29/2002

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
  Applicant must submit $ 740 to complete the basic filing fee for a non-small entity. If appropriate, applicant may make a written assertion of entitlement to small entity status and pay the small entity filing fee (37 CFR 1.27).
- The oath or declaration is missing.
  A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.
- To avoid abandonment, a late filing fee or oath or declaration surcharge as set forth in 37 CFR 1.16(l) of $130 for a non-small entity, must be submitted with the missing items identified in this letter.
- **The balance due by applicant is $ 870.**

A copy of this notice MUST be returned with the reply.

S. Young

Customer Service Center
Initial Patent Examination Division (703) 308-1202

PART 2 - COPY TO BE RETURNED WITH RESPONSE

05/10/2002 FAREABA1 00000084 10027821

01 FC:101 740.00 OP
02 FC:105 130.00 OP

#3

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MAY 0 9 2002
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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION
(37 CFR 1.63)

☒ Declaration Submitted with Initial Filing, OR
☒ Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)

Attorney Docket Number 1400.1374890
First Named Inventor Proulx, et al.
COMPLETE IF KNOWN
Application Number: 10/027,821
Filing Date: December 19, 2001
Group Art Unit : 2673
Examiner Name Unknown

COPY OF PAPERS ORIGINALLY FILED

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.
I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

METHOD AND SYSTEM FOR IP LINK MANAGEMENT

the specification of which:
☐ is attached hereto.
☒ was filed on (MM/DD/YYYY) 12-19-21001 as United States Application Number 10/027,821 and was amended on (MM/DD/YY.YY) (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.
I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? YES	NO
			☐	☐	☐
			☐	☐	☐

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Data (MM/DD/YYYY)

☐ Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application or PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

Attorney Docket No.:1400.1374890

As a named inventor, I hereby appoint the following registered practitioner(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Ross D. Snyder, Reg. No. 37,730

☐ Additional registered practitioner(s) named on supplemental Registered Practitioner Information sheet PTO/SB/02C attached hereto.

Direct all correspondence to:

Ross D. Snyder & Associates, Inc.
115 Wild Basin R ad-Suite 107
Austin, Texas 78746
Telephone: 512-347-9223
Facsimile: 512-347-9224

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any])			Family Name or Surname	
~~Dennis~~ Denis			Proulx	
Inventor's Signature	Denis Proulx		Date	Feb/27/2002
Residence	City: Kanata	State: Ontario	Country: Canada	Citizenship: Canadian
Post Office Address	1435 Houston Crescent			
City: Kanata	State: Ontario	ZIP: K2W 1B6	Country: Canada	

Name of Additional Joint Inventor: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any])			Family Name or Surname	
Chuong Ngoc			Ngo	
Inventor's Signature	Ngo Ngoc Chuong		Date	Feb 27, 2002
Residence	City: Ottawa	State: Ontario	Country: Canada	Citizenship: Canadian
Post Office Address	1 Westwinds Place			
City: Ottawa	State: Ontario	ZIP: K2G 6G5	Country: Canada	

Name of Additional Joint Inventor: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any])			Family Name or Surname	
Attaullah			Zabihi	
Inventor's Signature	[signature]		Date	2002/02/27
Residence	City: Ottawa	State: Ontario	Country: Canada	Citizenship: Canadian
Post Office Address	1712-1081 Ambleside Drive			
City: Ottawa	State: Ontario	ZIP: K2B 8C8	Country: Canada	

Name of Additional Joint Inventor: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any])			Family Name or Surname	
David Wing-Chung			Chan	
Inventor's Signature	David Chan		Date	28 Feb 2002.
Residence	City: Nepean	State: Ontario	Country: Canada	Citizenship: Canadian
Post Office Address	39 Mattamy Place			
City: Nepean	State: Ontario	ZIP: K2G 6J9	Country: Canada	

Name of Additional Joint Inventor: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any])			Family Name or Surname	
Felix			Katz	
Inventor's Signature	[signature]		Date	28 Feb 2002
Residence	City: Ottawa	State: Ontario	Country: Canada	Citizenship: Canadian
Post Office Address	1147 Ambleside Drive			
City: Ottawa	State: Ontario	ZIP: K2B 8E2	Country: Canada	

☐ Additional inventors are being named on the ______ supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto.

O!PE JC17
MAY 0 9 2002
PATENT & TRADEMARK OFFICE

PATENT APPLICATION #4

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Proulx, et al.

Title: METHOD AND SYSTEM FOR IP LINK MANAGEMENT

App. No.: 10/027,821 Filed: 12/19/2001

Examiner: Group Art Unit: 2673

COPY OF PAPERS ORIGINALLY FILED

Atty. Dkt. No. 1400.1374890

Assistant Commissioner for Patents
Washington, D.C. 20231

PETITION FOR EXTENSION OF TIME

Dear Sir:

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a response in the above identified application.

The requested extension and appropriate fees are as follows:

- ☐ One month (37 CFR 1.17(a)(1)) $110.00
- ☒ Two months (37 CFR 1.17(a)(1)) $400.00
- ☐ Three months (37 CFR 1.17(a)(1)) $920.00
- ☐ Four months (37 CFR 1.17(a)(1)) $1440.00
- ☐ Five months (37 CFR 1.17(a)(1)) $1960.00

☐ Applicant is a small entity under 37 CFR 1.9 and 1.25, therefore the fee amount shown above is reduced by one-half, and the resulting fee is: $. A small entity statement under 37 CFR 1.27 ☐ is enclosed or ☐ has already been filed in this application.

☒ A check in the amount of the fee is enclosed.

☐ The Commissioner has already been authorized to charge fees in this application to a Deposit Account.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 50-1566. Enclosed is a duplicate copy of this sheet.

04/30/2002
Date

Respectfully submitted,

Ross D. Snyder

Ross D. Snyder, Reg. No. 37,730
Attorney for Applicant(s)
Ross D. Snyder & Associates, Inc.
115 Wild Basin Road, Suite 107
Austin, Texas 78746
(512) 347-9223 (phone)
(512) 347-9224 (fax)

05/10/2002 FARRAHA1 00000086 10027821
01 FC:116 400.00 OP

10/027,821 **Method and system for IP link management** **04-21-2010::07:13:54**

Patent Assignment Abstract of Title

Total Assignments: 1

Application #: 10027821 **Filing Dt:** 12/19/2001 **Patent #:** NONE **Issue Dt:**

PCT #: NONE **Publication #:** US20030137532 **Pub Dt:** 07/24/2003

Inventors: Denis Proulx, Attaullah Zabihi, Chuong Ngoc Ngo, David Wing-Chung Chan, Felix Katz

Title: Method and system for IP link management

Assignment: 1

Reel/Frame: 012876 / 0474 **Received:** 05/14/2002 **Recorded:** 05/09/2002 **Mailed:** 07/12/2002 **Pages:** 5

Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Assignors:	PROULX, DENIS	**Exec Dt:** 02/27/2002
	NGO, CHUONG NGOC	**Exec Dt:** 02/27/2002
	ZABIHI, ATTAULLAH	**Exec Dt:** 02/27/2002
	CHAN, DAVID WING-CHUNG	**Exec Dt:** 02/28/2002
	KATZ, FELIX	**Exec Dt:** 02/28/2002

Assignee: ALCATEL CANADA INC.
600 MARCH ROAD
KANATA, ONTARIO, CANADA K2K 2

Correspondent: ROSS D. SNYDER & ASSOCIATES, INC.
ROSS D. SNYDER
115 WILD BASIN ROAD, SUITE 107
AUSTIN, TEXAS 78746

Search Results as of: 04/21/2010 07:13:47 AM

Disclaimer:
Assignment information on the assignment database reflects assignment documents that have been actually recorded.
If the assignment for a patent was not recorded, the name of the assignee on the patent application publication or patent may be different.
If you have any comments or questions concerning the data displayed, contact OPR / Assignments at 571-272-3350

Close Window

Attorney Docket No.: 1400.1374890

FORM PTO-1595 (Rev. 6-93)
OMB No. 0651-0011 (exp. 4/94)

RECORDATION FORM COVER SHEET

PATENTS ONLY

U.S. Department of Commerce
Patent and Trademark Office

To the Commissioner of Patents and Trademarks: Please record the attached original document(s) or copy(ies).

1. Name of conveying party(ies):

(a) Denis Froulx	(b) Chuong Ngoc Ngo
(c) Attaullah Zabihi	(d) David Wing-Chung Cang
(e) Felix Katz	(f)

Additional name(s) of conveying party(ies) attached? ☐ Yes ☒ No

3. Nature of conveyance:

☒ Assignment ☐ Merger
☐ Security Agreement ☐ Change of Name
☐ Other

Execution Date:

(a) 02-27-02	(b) 02-27-02
(c) 02-27-02	(d) 02-28-02
(e) 02-28-02	(f)

2. Name and address of receiving party(ies):

ALCATEL CANADA INC.
600 March Road
Kanata, Ontario
Canada K2K 2E6

Additional name(s) & address(es) attached? ☐ Yes ☒ No

4. Application number(s) or registration number(s): 10/027,821; Attorney Docket No: **1400.1374890**
METHOD AND SYSTEM FOR IP LINK MANAGEMENT

If this document is being filed together with a new application, the execution date of the application is:

A. Patent Application No.(s):

10/027,821

B. Patent No.(s):

Additional numbers attached? ☐ Yes ☒ No

5. Name and address of party to whom correspondence concerning document should be mailed:

Name: **Ross D. Snyder**
Ross D. Snyder & Associates, Inc.
115 Wild Basin Road
Suite 107
City: **Austin** State: **Texas** Zip: **78746**

6. Total number of applications and patents involved: 1

7. Total fee (37 C.F.R. 3.41) .... $ 40.00
☒ Enclosed
☒ Authorized to be charged to deposit account if check insufficient or inadvertently omitted

8. Deposit account number: 50-1566
(Attach duplicate copy of this page if paying by deposit account)

DO NOT USE THIS SPACE

9. Statement and signature.

To the best of my knowledge and belief, the foregoing information is true and correct and any attached copy is a true copy of the original document.

Ross D. Snyder, Reg. No. 37,730 — Ross D. Snyder — 04/30/02

Name and Registration Number of Person Signing — Signature — Date

Total number of pages including cover sheet, attachments and documents: 5

Mail documents to be recorded with required cover sheet information to:
Commissioner of Patents and Trademarks, Office of Public Records,
Crystal Gateway 4, Room 335, Washington, D.C. 20231

ASSIGNMENT OF U.S. PATENT APPLICATION

This is an assignment of patent rights between the inventor(s)

Denis Proulx	**Chuong Ngoc Ngo**
Attaullah Zabihi	**David Wing-Chung Chan**
Felix Katz	

(herein after referred to as the Inventor) and **ALCATEL CANADA INC.** having a place of business at 600 March Road, Kanata, Ontario, Canada K2K 2E6 (herein after referred to as the Assignee).

WHEREAS, Inventor has caused to be prepared on December 19, 2001, a United States Patent Application Number 10/027,821 in the Inventor's name entitled

METHOD AND SYSTEM FOR IP LINK MANAGEMENT

having a docket number of **1400.1374890** (herein after referred to as the Patented Invention); and

WHEREAS, Assignee has a desire to acquire all rights, title, and interest in the Patented Invention.

NOW, THEREFORE, the parties agree as follows:

1. The Inventor hereby sells, assigns, and transfers its entire rights, title, and interest in the Patented Invention and all patents that may be granted therefrom due to divisions, reissue, substitutions, extensions, continuations, and continuations-in-part to the Assignee.

2. The Inventor hereby sells, assigns, and transfers its entire rights, title, and interest in any foreign (non U.S.) national patent application, invention registration, or equivalent (Foreign Applications), claiming approximately the same subject matter of the Patented Invention to the Assignee.

3. In consideration for the sum of one dollar ($1) U.S. (or its equivalent) and other consideration for which both parties acknowledge to be valuable, having been conveyed to the Inventor by the Assignee for the sale, assignment, and transfer of the Patented Invention and Foreign Applications. Consideration may include at least one of: employment, an independent contractor agreement, monetary payment, or other benefit hereby acknowledged as received.

4. Inventor hereby authorizes and requests the Commissioner of Patents and Trademarks to issue the patent for the Patented Invention, and all resulting patents therefrom, insofar as Inventor's interest is concerned, to the Assignee.

5. The Inventor further agrees to execute any and all powers of attorney, applications, assignments, declarations, affidavits, and any other papers in connection therewith necessary to perfect such rights, title, and interest in the Assignee.

6. The Inventor hereby further agrees to communicate with the Assignee any facts its knows regarding any improvements of the Patented Invention while employed by Assignee and for one year thereafter.

7. The Inventor hereby yet further agrees to, at the expense of the Assignee:
   i) testify in any legal proceedings,
   ii) sign all lawful papers,
   iii) execute all divisional, continuation, continuation-in-part, reissue and substitute applications,
   iv) make all lawful oaths, and assist in vesting title in the Assignee and to aid the Assignee to obtain and enforce proper protection for the subject matter of the Patented Invention in all countries, and
   v) notify Assignee promptly (by facsimile or first class mail) of any subpoena or contact by any person other than Assignee or its agents regarding the Application or resultant patent(s) issuing therefrom, and in any event at least one week prior to any deposition, legal inquiry or legal proceeding relating to the above identified invention.

This assignment is executed on the date(s) of which the Inventor has signed.

Inventor:

Denis Proulx	Date: Feb/27/2002
Chuong Ngoc Ngo	Date: Feb 27, 2002
Attaullah Zabihi	Date: 2002/02/27
David Wing-Chung Chan	Date: 28 Feb 2002
Felix Katz	Date: 28 Feb 2002

STATEMENT OF WITNESS

I, Maxine Raycroft, whose full post office address is 7 Scheel Drive, Arnprior Ont K7S3C8, state that I was personally present and did see **Denis Proulx**, who is personally known to me to be the person named in the above assignment, duly sign and execute the same on the date set forth above.

Maxine Raycroft
(Signature of Witness)

STATEMENT OF WITNESS

I, Maxine Raycroft, whose full post office address is 7 Scheel Dr. Arnprior Ont K7S3C8, state that I was personally present and did see **Chuong Ngoc Ngo**, who is personally known to me to be the person named in the above assignment, duly sign and execute the same on the date set forth above.

Maxine Raycroft
(Signature of Witness)

STATEMENT OF WITNESS

I, Maxine Raycroft, whose full post office address is 7 Scheel Dr. Arnprior Ont K7S3C8, state that I was personally present and did see **Attaullah Zabihi**, who is personally known to me to be the person named in the above assignment, duly sign and execute the same on the date set forth above.

Maxine Raycroft
(Signature of Witness)

STATEMENT OF WITNESS

I, Maxine Raycroft, whose full post office address is 7 Scheel DR. Arnprior Ont K7S3C8, state that I was personally present and did see **David Wing-Chung Chan**, who is personally known to me to be the person named in the above assignment, duly sign and execute the same on the date set forth above.

Maxine Raycroft
(Signature of Witness)

STATEMENT OF WITNESS

I, Maxine Raycroft, whose full post office address is 7 Select Drive, Arnprior Ont K7S3G8, state that I was personally present and did see **Felix Katz**, who is personally known to me to be the person named in the above assignment, duly sign and execute the same on the date set forth above.

Maxine Raycroft
(Signature of Witness)

JUN 1 0 2004
PATENT & TRADEMARK OFFICE

2673

PTO/SB/21 (02-04)
Approved for use through 07/31/2006. OMB 0651-0031
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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	10/027,821
Filing Date	12-19-2001
First Named Inventor	Denis Proulx, et al.
Art Unit	2673
Examiner Name	Unknown
Attorney Docket Number	1400.1374890
Total Number of Pages in This Submission	176

ENCLOSURES *(Check all that apply)*

- [ ] Fee Transmittal Form
  - [ ] Fee Attached
- [ ] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [x] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Response to Missing Parts/ Incomplete Application
  - [ ] Response to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) ____________
- [ ] After Allowance communication to Technology Center (TC)
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to TC (Appeal Notice, Brief, Reply Brief)
- [ ] Proprietary Information
- [ ] Status Letter
- [x] Other Enclosure(s) (please identify below):

Return Receipt Postcard

Remarks

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JUN 1 5 2004
Technology Center 2600

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm or Individual name	Ross D. Snyder, Reg. No. 37,730
Signature	Ross D. Snyder
Date	06-07-2004

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below.

Typed or printed name	Terri Alloway		
Signature	Terri Alloway	Date	06-07-2004

This collection of information is required by 37 CFR 1.5. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

OIPE JC148
JUN 1 0 2004
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PTO/SB/08A (08-03)
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Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	10/027,821
Filing Date	12-19-2001
First Named Inventor	Denis Proulx, et al.
Art Unit	2673
Examiner Name	Unknown
Attorney Docket Number	1400.1374890

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number: Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US-5,175,800	12-29-1992	Galis et al.	
		US-5,491,796	02-13-1996	Wanderer et al.	
		US-5,500,934	03-19-1996	Austin et al.	RECEIVED
		US-5,872,928	02-16-1999	Lewis et al.	
		US-			JUN 1 5 2004
		US-			
		US-			Technology Center 2600
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FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document: Country Code[3] -Number[4] -Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3]Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

P.B.5818 – Patentlaan 2
2280 HV Rijswijk (ZH)
☏ +31 70 340 2040
TX 31651 epo nl
FAX +31 70 340 3016

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Zweigstelle in Den Haag Recherchen-abteilung | Branch at The Hague Search division | Département à La Haye Division de la recherche

05/06/04

Feray, Valérie
Feray Lenne Conseil
44/52, Rue de la Justice
75020 Paris
FRANCE

RECU LE
05 FEV. 2004
Cabinet FERAY-LENNE

SAISI LE
20 FEV. 2004

Datum/Date
05.02.04

Zeichen/Ref./Réf.	Anmeldung Nr./Application No./Demande n°./Patent Nr./Patent No./Brevet n°.
P000526	02293090.3-1525-

Anmelder/Applicant/Demandeur/Patentinhaber/Proprietor/Titulaire
Alcatel Canada Inc.

COMMUNICATION

The European Patent Office herewith transmits as an enclosure the European search report for the above-mentioned European patent application.

If applicable, copies of the documents cited in the European search report are attached.

☐ Additional set(s) of copies of the documents cited in the European search report is (are) enclosed as well.

The following specifications given by the applicant have been approved by the Search Division:

☒ abstract ☒ title

☐ The abstract was modified by the Search Division and the definitive text is attached to this communication.

The following figure will be published together with the abstract: 7

REFUND OF THE SEARCH FEE

If applicable under Article 10 Rules relating to fees, a separate communication from the Receiving Section on the refund of the search fee will be sent later.

EPO Form 1507.0 (03.95)

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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 29 3090

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 5 872 928 A (LEWIS LUNDY ET AL) 16 February 1999 (1999-02-16) * column 10, line 25 - column 12, line 59 * * column 14, line 60 - column 15, line 9 * * figure 14 *	1-16	H04L12/24
A	US 5 175 800 A (PAGE STUART ET AL) 29 December 1992 (1992-12-29) * column 3, line 48 - column 4, line 60 * * column 5, line 45 - column 5, line 61 * * column 9, line 53 - column 12, line 20 * * column 13, line 51 - column 14, line 32 * * column 17, line 55 - column 18, line 18 * * column 24, line 32 - column 26, line 52 * * column 27, line 19 - column 28, line 68 * * column 44, line 10 - line 20 * * column 45, line 40 - column 46, line 17 * * column 47, line 1 - column 49, line 35 * * column 53, line 40 - column 54, line 25 * * column 56, line 41 - column 59, line 12 *	1-16	TECHNICAL FIELDS SEARCHED (Int.Cl.7) H04L
A	US 5 491 796 A (CHEN MICHELE ET AL) 13 February 1996 (1996-02-13) * column 1, line 40 - line 50 * * column 2, line 32 - column 5, line 55 *	1-16	

-/--

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	29 January 2004	Siebel, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

1

EPO FORM 1503 03.82 (P04C01)

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 29 3090

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	US 5 500 934 A (BOHN CAROLE A ET AL) 19 March 1996 (1996-03-19) * column 1, line 11 - column 5, line 16 * * column 7, line 35 - line 63 * * column 9, line 65 - column 12, line 65 * * claim 11 * -----	1-16	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
BERLIN	29 January 2004	Siebel, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 02 29 3090

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

29-01-2004

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 5872928	A	16-02-1999	US	5832503 A	03-11-1998
			AU	702607 B2	25-02-1999
			AU	5183796 A	11-09-1996
			EP	0811284 A1	10-12-1997
			WO	9626588 A1	29-08-1996
			US	6421719 B1	16-07-2002
			US	6381639 B1	30-04-2002
			US	6243747 B1	05-06-2001
			US	5889953 A	30-03-1999
US 5175800	A	29-12-1992	GB	2206713 A ,B	11-01-1989
US 5491796	A	13-02-1996	AU	5404194 A	24-05-1994
			WO	9410625 A1	11-05-1994
US 5500934	A	19-03-1996	NONE		

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/027,821	12/19/2001	Denis Proulx	1400.1374890	9507

25697 7590 08/27/2004

ROSS D. SNYDER & ASSOCIATES, INC.
115 WILD BASIN RD.
SUITE 107
AUSTIN, TX 78746

EXAMINER	
ARSHAD, UMAR	

ART UNIT	PAPER NUMBER
2174	

DATE MAILED: 08/27/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)
	10/027,821	PROULX ET AL.
	Examiner	Art Unit
	Umar Arshad	2174

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 19 December 2001.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-16 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-16 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 6/10/2004.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1 – 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hansen, U.S. Patent No. 6,772,204 in view of Lam et al., U.S. Patent No. 6,381,237.

As per claim 1, Hansen teaches a network administration method for provisioning logical configuration links for at least two network devices through a dedicated graphical user interface form, the method comprising:

selecting a network device having at least one network interface through the dedicated graphical user interface form (see Hansen, column 12, lines 36 – 45);

determining local interface and next neighbor information for the network device (see Hansen, column 12, lines 62 – 66);

determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database (see Hansen, column 13, lines 40 – 48);

validating the new logical configuration link (see Hansen, column 13, lines 25 – 33);

sending the new logical configuration link to the network device (see Hansen, column 15, lines 4 – 13); and

displaying a graphical representation of the new logical configuration link on a display device (see Hansen, column 13, lines 52 – 56).

Hansen does not teach creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database and storing the new logical configuration link in the logical link database. Lam teaches creating a new logical configuration link when connection information is not associated with any of the logical configuration links in the logical link database and storing the new logical configuration link in the logical link database (see Lam, column 9, lines 1 – 6).

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Lam with the method of Hansen in order to provide an up-to-date interface to the user.

As per claim 2, which is dependent on claim 1, Hansen and Lam teach the method of claim 1 (see rejection above). Hansen further teaches the method of claim 1,

wherein the step of creating a new logical configuration link further comprises the steps of:

selecting a link type (see Hansen, column 13, lines 5 – 8);

selecting a link numbering type for the new logical configuration link (see Hansen, column 14, lines 26 – 33);

selecting a link application for the new logical configuration link (see Hansen, column 14, lines 26 – 33);

selecting a sub layer interface type for the new logical configuration link (see Hansen, column 14, lines 26 – 33);

creating a first endpoint for the new logical configuration link; and

creating a second endpoint for the new logical configuration link (see Hansen, column 12, lines 36 – 45).

As per claim 3, which is dependent on claim 2, Hansen and Lam teach the method of claim 2 (see rejection above). Hansen further teaches the method of claim 2, wherein the step of selecting the link type further comprises the step of selecting a point-to-point link type (see Hansen, column 13, lines 5 – 8).

However, Hansen does not selecting the link type from among a group consisting of: point-to-point, point-to-IP, and point-to-subnet. The examiner takes official notice that point-to-IP and point-to-subnet link types are notoriously well known in the art of computer networks. It would have been obvious to one of ordinary skill in the art at the

time of the invention to incorporate point-to-IP and point-to-subnet link types with the method of Hansen in order to provide access to well established configurations.

As per claim 4, which is dependent on claim 2, Hansen and Lam teach the method of claim 2 (see rejection above). Hansen further teaches the method of claim 2, wherein the step of selecting a link numbering type further comprises the step of selecting a numbered link numbering type (see Hanson, column 14, lines 26 - 28).

Hansen does not teach selecting the link numbering type from a group consisting of: a numbered type and an unnumbered type. However, the unnumbered link numbering type is notoriously well known in the art of computer networks. It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the unnumbered link numbering type with the method of Hansen in order to provide access to well established configurations.

As per claim 5, which is dependent on claim 2, Hansen and Lam teach the method of claim 2 (see rejection above). Hansen does not teach the method of claim 2, wherein the step of selecting a link application further comprises the step of: selecting the link application from a group consisting of: Internet Protocol Forwarding, Multi-protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching.

However, Internet Protocol Forwarding, Multi-protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching are notoriously well

known in the art of computer networks. It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate Internet Protocol Forwarding, Multi-protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching with the method of Hansen in order to provide access to well established configurations.

As per claim 6, which is dependent on claim 2, Hansen and Lam teach the method of claim 2 (see rejection above). Hansen does not teach the method of claim 2, wherein the step of selecting a sub layer interface type further comprises the step of:

selecting the sub layer interface type from a group consisting of: Packet Over Sonet, Asynchronous Transfer Mode, and GigEthemet.

However, Packet Over Sonet, Asynchronous Transfer Mode, and GigEthemet are notoriously well known in the art of computer networks. It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate Packet Over Sonet, Asynchronous Transfer Mode, and GigEthemet with the method of Hansen in order to provide access to well established configurations.

As per claim 7, which is dependent on claim 1, Hansen and Lam teach the method of claim 1 (see rejection above). Hansen does not teach the method of claim 1, further comprising the step of: modifying a logical configuration link in the logical link database.

Lam teaches modifying a logical configuration link in the logical link database (see Lam, column 10, lines 8 – 15). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Lam with the method of Hansen in order to provide an up-to-date interface to the user.

As per claim 8, which is dependent on claim 1, Hansen and Lam teach the method of claim 1 (see rejection above). Hansen further teaches the method of claim 1, further comprising the step of:

deleting a logical configuration link in the logical link database (see Hansen, column 13, lines 37 – 39).

As per claim 9, Hansen teaches an apparatus for provisioning logical configuration links comprising:

storing logical configuration links (see Hansen, column 14, lines 53 – 61);

a processing system for accessing the stored logical configuration links; and

a display device coupled to the processing system for displaying a graphical user interface form comprising a graphical representation of a logical configuration link (see Hansen, column 3, lines 12 – 20 and column 5, lines 19 – 26).

Hansen does not teach a logical link database for storing logical configuration links. Lam teaches a logical link database for storing logical configuration links (see Lam, column 1, lines 56 – 58). It would have been obvious to one of ordinary skill in the art

art at the time of the invention to incorporate the method of Lam with the method of Hansen in order to provide a resource of data describing connections in a network.

As per claim 10, which is dependent on claim 9, Hansen and Lam teach the method of claim 9 (see rejection above). Hansen further teaches the apparatus of claim 9 wherein the display device provides an ability to select a network device having at least one network interface through the graphical user interface form (see Hansen, column 12, lines 36 – 45).

As per claims 11 – 16, they all recite limitations that are addressed in the rejection for claim 1 and are rejected in the same rationale as they are rejected in claim 1 (see rejection above).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Umar Arshad whose telephone number is (703) 305-0329. The examiner can normally be reached on Monday - Friday, 9am - 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kristine L Kincaid can be reached on (703) 308-0640. The fax phone

number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

UA

Kristine Kincaid
KRISTINE KINCAID
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2100

OIPE JC145
JUN 10 2004
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PTO/SB/08A (08-03)
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Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	10/027,821
Filing Date	12-19-2001
First Named Inventor	Denis Proulx, et al.
Art Unit	2673
Examiner Name	Unknown
Attorney Docket Number	1400.1374890

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2 (if known)]	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
UA		US-5,175,800	12-29-1992	Galis et al.	
UA		US-5,491,796	02-13-1996	Wanderer et al.	
UA		US-5,500,934	03-19-1996	Austin et al.	RECEIVED
UA		US-5,872,928	02-16-1999	Lewis et al.	
		US-			JUN 15 2004
		US-			
		US-			Technology Center 2600
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FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] Number[4] Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]

Examiner Signature	[signature]	Date Considered	8/18/04

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

Notice of References Cited	Application/Control No. 10/027,821	Applicant(s)/Patent Under Reexamination PROULX ET AL.	
	Examiner Umar Arshad	Art Unit 2174	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-6,772,204 B1	08-2004	Hansen, Peter A.	709/220
	B	US-6,381,237 B1	04-2002	Lam et al.	370/351
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action: (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

OIPE JCA8
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PTO/SB/21 (02-04)
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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	10/027,821
Filing Date	12-19-2001
First Named Inventor	Denis Proulx, et al.
Art Unit	2174
Examiner Name	Arshad, Umar
Attorney Docket Number	1400.1374890

Total Number of Pages in This Submission: 13

ENCLOSURES *(Check all that apply)*

- [ ] Fee Transmittal Form
  - [x] Fee Attached
- [x] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [x] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Response to Missing Parts/ Incomplete Application
  - [ ] Response to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) ______
- [ ] After Allowance communication to Technology Center (TC)
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to TC (Appeal Notice, Brief, Reply Brief)
- [ ] Proprietary Information
- [ ] Status Letter
- [x] Other Enclosure(s) (please Identify below):

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Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm or Individual name	Ross D. Snyder, Reg. No. 37,730
Signature	Ross D. Snyder
Date	January 27, 2005

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below.

Typed or printed name	Ross D. Snyder, Reg. No. 37,730		
Signature	Ross D. Snyder	Date	January 27, 2005

PTO/SB/22 (12-04)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARMENT OF COMMERCE
Under the paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a) **FY 2005** *(Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).)*	Docket Number (Optional) 1400.1374890
Application Number 10/027,821	Filed 12-19-2001
For METHOD AND APPARATUS FOR IP LINK MANAGEMENT	
Art Unit 2174	Examiner Arshad, Umar

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

	Fee	Small Entity Fee	
☐ One month (37 CFR 1.17(a)(1))	$120	$60	$
☒ Two months (37 CFR 1.17(a)(2))	$450	$225	$ $450.00
☐ Three months (37 CFR 1.17(a)(3))	$1020	$510	$
☐ Four months (37 CFR 1.17(a)(4))	$1590	$795	$
☐ Five months (37 CFR 1.17(a)(5))	$2160	$1080	$

☐ Applicant claims small entity status. See 37 CFR 1.27.

☒ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 50-1566. I have enclosed a duplicate copy of this sheet.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the ☐ applicant/inventor.

☐ assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) is enclosed (Form PTO/SB/96).

☒ attorney or agent of record. Registration Number 37,730

☐ attorney or agent under 37 CFR 1.34.
Registration number if acting under 37 CFR 1.34 ______

[signature] January 27, 2005
Signature Date

Ross D. Snyder, Reg. No. 37,730 (512) 347-9223
Typed or printed name Telephone Number

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.

☐ Total of ______ forms are submitted.

This collection of information is required by 37 CFR 1.136(a). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 6 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

OIPE FEB 0 2 2005 JC48 PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT 2174 JFW

Applicant(s): Denis Proulx, et al.

Title: METHOD AND SYSTEM FOR IP LINK MANAGEMENT

App. No.: 10/027,821 Filed: 12-19-2001

Examiner: Arshad, Umar Group Art Unit: 2174

Atty. Dkt. No. 1400.1374890

Mail Stop Amendment
Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

RESPONSE

Dear Sir:

In response to the Office action of August 27, 2004, please amend the above-identified application as follows:

In the Specification:

Please delete the paragraph found on page 5, line 23, through page 6, line 3, of the specification and replace it with the following paragraph:

The configuration of large networks changes frequently due to addition, removal and/or replacement of network devices. To effectively manage large networks such that IP packets are routed correctly over the network, the network manager must know when data forwarding network devices are added or removed. One system used to discover network devices with data forwarding capabilities is described in U.S. Patent Application No. 10/029,124, filed December 19, 2001, titled "Method and Apparatus for Automatic Discovery of Network Devices with Data Forwarding Capabilities," assigned to the assignee of the present invention and incorporated by reference herein.

Please delete the paragraph found on page 6, line 19, through page 7, line 2, of the specification and replace it with the following paragraph:

In addition to knowing the identity and physical configuration of the network devices themselves, it is also important for the network manager to be able to monitor logical connections between network devices. A logical connection exists between network devices when at least one port of a first network device is configured so that a message sent out through that port would arrive at a known destination (either a network address or a second network device). The destination may be a particular port or interface on another network device, a particular IP address, or a particular subnetwork. One system used to discover logical links between network devices is described in U.S. Patent Application No. 10/029,123, filed December 19, 2001, titled "Method and Apparatus for Automatic Discovery of Logical Links between Network Devices," assigned to the assignee of the present invention, and incorporated by reference herein.

Please delete the paragraph found on page 25, lines 1-14, of the specification and replace it with the following paragraph:

An IP Link can be created via the embodied NMS GUI manually, by SNMP IP Link trap for some routers, or by the auto-discovery process (per co-pending Application No.10/029,123, "Method and Apparatus for Automatic Discovery of Logical Links between Network Devices"). An example of

an IP link provisioning GUI window according to at least one embodiment of the present invention is shown in Figure 4, and generally designated example GUI window 400. GUI window 400 typifies what a user would see for provisioning a new point-to-point IP link by opening the New->Link->IP Link->Point-to-Point configuration form (not illustrated). A window title 405 appears at the top of the form to indicate the purpose of the window. The user may select the Link Numbering Type (Numbered or Unnumbered) with Link Numbering Type selection button 407. Link Numbering Type selection button 407 has "Numbered" selected in the example of Figure 4. The user may also select the Link Application (IP Forwarding, IP Forwarding and MPLS, or MPLS) with the Link Application selection button 408. In the same manner, the Link Sub layer Interface (ATM, POS, GigEthernet) may be selected with the Link Sub Layer Interface selection button 409.

REMARKS/ARGUMENTS

Claims 1-16 are pending in the present application. The Examiner has rejected claims 1-16. Applicant respectfully requests reconsideration of pending claims 1-16.

The Examiner has rejected claims 1-16 under 35 U.S.C. § 103(a) as being unpatentable over Hansen (U.S. Patent No. 6,772,204) in view of Lam et al. (U.S. Patent No. 6,381,237). Applicant respectfully disagrees.

Regarding claim 1, the Examiner acknowledges, "Hansen does not teach creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database and storing the new logical configuration link in the logical link database," but asserts, "Lam teaches creating a new logical configuration link when connection information is not associated with any of the logical configuration links in the logical link database and storing the new logical configuration link in the logical link database (see Lam, column 9, lines 1-6)." Applicant notes that the Examiner does not allege Lam et al. as teaching "creating a new logical configuration link when *the local interface and next neighbor information* is not associated with any of the logical configuration links in the logical link database." Applicant can find no mention of a "local interface" or "next neighbor information" in the portion of the Lam et al. reference cited by the Examiner.

Moreover, Applicant notes that the Examiner asserts that Hansen teaches "validating the new logical configuration link," "sending the new logical configuration link to the network device," and "displaying a graphical representation of the new logical configuration link on a display device," yet the Examiner acknowledges, "Hansen does not teach creating a new logical configuration link...." Applicant submits that Hansen's acknowledged failure to disclose "creating a new logical configuration link..." impairs the Examiner's argument that Hansen teaches "validating the new logical configuration link," "sending the new logical configuration link to the network device," and "displaying a graphical representation of the new logical configuration link on a display device."

Furthermore, regarding "determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database," the Examiner cites column 13, lines 40-48, of the Hansen reference, which states, "Returning to step 154, if it is determined that both the origination and destination devices or

entities have available slots, the method proceeds to step 160, where a connection interface is selected for the originating device and on to step 162 where a connection interface is selected for the destination device or entity. At both of these steps, the network administrator may select any one of a list of available connection interfaces overlayed on the network configuration map 106 by the network device configuration tool 10." Applicant can find no mention of "a plurality of logical configuration links in a logical link database." Also, Applicant can find no mention of "determining whether the local interface and next neighbor information is associated with a logical configuration link...."

Also, while the Examiner appears to assert that "a connection interface is selected for the originating device" (Hansen, column 13, lines 42 and 43) teaches "the local interface" and "a connection interface is selected for the destination device or entity" (Hansen, column 13, lines 44 and 45) teaches "next neighbor information," Applicant can find no mention of such features in the portion of Hansen (column 12, lines 62-66) cited by the Examiner as allegedly teaching "determining local interface and next neighbor information for the network device." Thus, Applicant submits that the Examiner's assertions are mutually inconsistent. Accordingly, Applicant submits that the cited references fail to teach or suggest the claimed invention as set forth in claim 1. Therefore, Applicant submits that claim 1 is in condition for allowance.

Regarding claim 2, Applicant notes that the Examiner acknowledged that the Hansen reference does not teach "creating a new logical configuration link...," but asserts that Hansens teaches "wherein the step of creating a new logical configuration link further comprises...." Moreover, the Examiner asserts that Hansen teaches "selecting a link type" in column 13, lines 5-8. However, in column 13, lines 12 and 13, Hansen states, "Specfically, the device has four connection interfaces – two ethernet ports and two serial ports." Applicant notes that Hansen refers to "connection interfaces," not "a link type."

Also, the Examiner cites column 14, lines 26-33, of Hansen as teaching "selecting a link numbering type for the new logical configuration link." However, column 14, lines 26-33, state, "Thus, in this example, the network administrator would be asked whether the serial port should be configured, the IP address and mask for the port, the IPX network number, whether the port should be configured for frame relay, the type of connector being used for the port, the local data link connection identifier (or "DLCI"), the Committed Information Rate (or "CIR") and the Excess Information Rate

(or "EIR") for the port and whether to use compression." Applicant can find no mention of a "link numbering type" in that portion of the Hansen reference.

Applicant submits, according to the foregoing examples, that the cited references fail to teach or suggest the claimed invention as set forth in claim 2. Therefore, Applicant submits that claim 2 is in condition for allowance.

Regarding claim 3, the Examiner asserts that point-to-IP and point-to-subnet link types are "notoriously well known in the art of computer networks" and attempt to combine such assertion with two of what Hansen specifically refers to as "connection interfaces" to allegedly yield teaching of "selecting the link type from among a group consisting of: point-to-point, point-to-IP, and point-to-subnet." Applicant notes that the Examiner does not identify any reference that would disclose the recited features. Moreover, Applicant submits that the Examiner's assertions are far to tenuous to allegedly render obvious the claimed invention as set forth in claim 3. Thus, Applicant submits that claim 3 is in condition for allowance.

Regarding claim 4, the Examiner acknowledges, "Hansen does not teach selecting the link numbering type from a group consisting of: a numbered type and an unnumbered type." However, the Examiner asserts, "the unnumbered link numbering type is notoriously well known in the art of computer networks." Nonetheless, the Examiner does not identify any reference that would disclose the recited features. Thus, Applicant submits that claim 4 is in condition for allowance.

Regarding claim 5, the Examiner acknowledges, "Hansen does not teach the method of claim 2, wherein the step of selecting a link application further comprises the step of: selecting the link application from a group consisting of: Internet Protocol Forwarding, Multi-protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching," yet the Examiner asserts such features are "notoriously well known in the art of computer networks," but does not identify any reference that would disclose the recited features. Moreover, the Examiner does not attempt to reconcile the teachings of column 14, lines 26-33, of Hansen, which the Examiner asserts as teaching "selecting a link application" with respect to claim 2, with the features recited in claim 5. Thus, Applicant submits that claim 5 is in condition for allowance.

Regarding claim 6, the Examiner acknowledges, "Hansen does not teach the method of claim 2, wherein the step of selecting a sub layer interface type further comprises the step of: selecting the sub layer interface type from a group consisting of: Packet Over Sonet, Asynchronous Transfer Mode, and GigEthernet," yet the Examiner asserts such features are "notoriously well known in the art of computer networks," but does not identify any reference that would disclose the recited features. Moreover, the Examiner does not attempt to reconcile the teachings of column 14, lines 26-33, of Hansen, which the Examiner asserts as teaching "selecting a link application" with respect to claim 2, with the features recited in claim 6. Thus, Applicant submits that claim 6 is in condition for allowance.

Regarding claim 7, the Examiner acknowledges, "Hansen does not teach the method of claim 1, further comprising the step of: modifying a logical configuration link in the logical link database," but asserts that Lam et al. teach such feature in column 10, lines 8-15. Applicant has already noted the apparent inconsistency of the teachings of Lam et al. with the features recited in claim 1. In light of such apparent inconsistency, Applicant further submits that "update the trail database 50" of Lam et al., as described in column 10, lines 8-15, fails to disclose "modifying a logical configuration link in the logical link database," as recited in claim 7. Thus, Applicant submits that claim 7 is in condition for allowance.

Regarding claim 8, the Examiner asserts that Hansen teaches "deleting a logical configuration link the logical link database" in column 13, lines 37-39. Applicant has already noted the apparent failure of Hansen to disclose the features recited in claim 1. In light of such apparent failure, Applicant further submits that "proposed connection is then deleted" of Hansen, as described in column 13, line 37, fails to disclose "deleting a logical configuration link in the logical link database," as recited in claim 8. For example, Hansen recites a "*proposed* connection," not "a logical configuration link." Moreover, Applicant can find no mention in the cited portion of Hansen of "in the logical link database." Thus, Applicant submits that claim 8 is in condition for allowance.

Regarding claim 9, the Examiner acknowledges, "Hansen does not teach a logical link database for storing logical configuration links," but asserts that Lam et al. teach such feature in column 1, lines 56-58. The Examiner further cites column 14, lines 53-61, of Hansen as disclosing "storing local configuration links." However, Applicant notes the cited portion of Hansen refers to "configuration commands contained therein" (column 14, lines 58 and 59), which appears to be inconsistent with the Examiner's assertions regarding the "trail database" of Lam et al. (column 1, line 57). Thus, Applicant

In conclusion, Applicant has overcome all of the Office's rejections, and early notice of allowance to this effect is earnestly solicited. If, for any reason, the Office is unable to allow the Application on the next Office Action, and believes a telephone interview would be helpful, the Examiner is respectfully requested to contact the undersigned attorney.

Respectfully submitted,

01/27/2005
Date

Ross D. Snyder, Reg. No. 37,730
Attorney for Applicant(s)
Ross D. Snyder & Associates, Inc.
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JW

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/027,821	12/19/2001	Denis Proulx	1400.1374890	9507

25697 7590 05/18/2005

ROSS D. SNYDER & ASSOCIATES, INC.
PO BOX 164075
AUSTIN, TX 78716-4075

EXAMINER	
KE, PENG	

ART UNIT	PAPER NUMBER
2174	

DATE MAILED: 05/18/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

h

Office Action Summary	Application No. 10/027,821	Applicant(s) PROULX ET AL.
	Examiner Peng Ke	Art Unit 2174

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 February 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

This action is responsive to communications: Amendment, filed on 2/2/05.

Claims 1-16 are pending in this application. Claims 1 and 9 are independent claims.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 9 and 10 are rejected under 35 U.S.C. 102(e) as being anticipated by Hansen, U.S. Patent No. 6,772,204.

As per claim 9, Hansen teaches an apparatus for provisioning logical configuration links comprising:

a logical link database for storing logical configuration links. (see Hansen, column 13, lines 40 – 48; It is inherent there is a database for storing `a list of available connection interface overlayed on the network configuration map).`

storing logical configuration links (see Hansen, column 14, lines 53 - 61); a processing system for accessing the stored logical configuration links; and a display device coupled to the processing system for displaying a graphical user interface form comprising a graphical representation of a logical configuration link (see Hansen, column 3, lines 12 - 20 and column 5, lines 19 - 26). Hansen does not teach Lam teaches a logical link database for storing logical

configuration links (see Lam, column 1, lines 56 - 58). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Lam with the method of Hansen in order to provide a resource of data describing connections in a network,

As per claim 10, which is dependent on claim 9, Hansen teaches the method of claim 9 (see rejection above). Hansen further teaches the apparatus of claim 9 wherein the display device provides an ability to select a network device having at least one network interface through the graphical user interface form (see Hansen, column 12, lines 36 - 45).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-8, and 11-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hansen, U.S. Patent No. 6,772,204 in view of Lam et al., U.S. Patent No. 6,381,237.

As per claim 1, Hansen teaches a network administration method for provisioning logical configuration links for at least two network devices through a dedicated graphical user interface form, the method comprising: selecting a network device having at least one network interface through the dedicated graphical user interface form (see Hansen, column 12, lines 36 - 45); determining local interface and next neighbor information for the network device (see Hansen, column 12, lines 62-66);

determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database (see Hansen, column 13, lines 40 - 48);

validating the new logical configuration link (see Hansen, column 13, lines 25 33);

sending the new logical configuration link to the network device (see Hansen, column 15, lines 4 -13); and

displaying a graphical representation of the new logical configuration link on a display device (see Hansen, column 13, lines 52 - 56).

Hansen does not teach creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link catabase and storing the new logical configuration link in the logical link database. Lam teaches creating a new logical configuration link when connection information is not associated with any of the logical configuration links in the logical link database and storing the new logical configuration link in the logical link database (see Lam, column 9, lines 1 - 6).

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Lam with the method of Hansen in order to provide an up-to-date interface to the user.

As per claim 2, which is deperdent on claim 1, Hansen and Lam teach the method of claim 1 (see rejection above). Hansen further teaches the method of claim 1,

wherein the step of creating a new logical configuration link further comprises the steps of: selecting a link type (see Hansen, column 13, lines 5 - 8); selecting a link numbering type for the new logical configuration link (see Hansen, column 14, lines 26 - 33); selecting a link application for the new logical configuration link (see Hansen, column 14, lines 26 - 33); selecting a sub layer interface type for the new logical configuration link (see Hansen, column 1 4, lines 26 - 33); creating a first endpoint for the new logical configuration link; and creating a second endpoint for the new logical configuration link (see Hansen, column 12, lines 36 - 45).

As per claim 3, which is dependent on claim 2, Hansen and Lam teach the method of claim 2 (see rejection above). Hansen further teaches the method of claim 2, wherein the step of selecting the link type further comprises the step of selecting a point-to-point link type (see Hansen, column 13, lines 5 - 8). However, Hansen does not selecting the link type from among a group consisting of: point-to-point, point-to-IP, and point-to-subnet. The examiner takes official notice that point-to-IP and point-to-subnet link types are notoriously well known in the art of computer networks. It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate point-to-IP and point-to-subnet link types with the method of Hansen in order to provide access to well established configurations.

As per claim 4, which is dependent on claim 2, Hansen and Lam teach the method of claim 2 (see rejection above). Hansen further teaches the method of claim 2, wherein the step of selecting a link numbering type further comprises the step of selecting a numbered link numbering type (see Hanson, column 14, lines 26 - 28).

Hansen does not teach selecting the link numbering type from a group consisting of: a numbered type and an unnumbered type. The examiner takes official notice that the unnumbered link numbering type is notoriously well known in the art of computer networks. It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the unnumbered link numbering type with the method of Hansen in order to provide access to well established configurations.

As per claim 5, which is dependent on claim 2, Hansen and Lam teach the method of claim 2 (see rejection above). Hansen does not teach the method of claim 2, wherein the step of selecting a link application further comprises the step of: selecting the link application from a group consisting of: Internet Protocol Forwarding, Multiprotocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching.

The examiner takes official notice that Internet Protocol Forwarding, Multi-protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching are notoriously well known in the art of computer networks. It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate Internet Protocol Forwarding, Multi-protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label

Switching with the method of Hansen in order to provide access to well established configurations.

As per claim 6, which is dependent on claim 2, Hansen and Lam teach the method of claim 2 (see rejection above). Hansen does not teach the method of claim 2, wherein the step of selecting a sub layer interface type further comprises the step of:

selecting the sub layer interface type from a group consisting of: Packet Over Sonet, Asynchronous Transfer Mode, and GigEthemet.

The examiner takes official notice that Packet Over Sonet, Asynchronous Transfer Mode, and GigEthemet are notoriously well known in the art of computer networks. It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate Packet Over Sonet, Asynchronous Transfer Mode, and GigEthemet with the method of Hansen in order to provide access to well established configurations.

As per claim 7, which is dependent on claim 1, Hansen and Lam teach the method of claim 1 (see rejection above). Hansen does not teach the method of claim 1, further comprising the step of: modifying a logical configuration link in the logical link database.

Lam teaches modifying a logical configuration link in the logical link database (see Lam, column 10, lines 8 - 15). It would have been obvious to one of ordinary skill in the art at the time of the invention lo incorporate the method of Lam with the method of Hansen in order to provide an up-to-date interface to the user.

As per claim 8, which is dependent on claim 1, Hansen and Lam teach the method of claim 1 (see rejection above). Hansen further teaches the method of claim 1, further comprising the step of: deleting a logical configuration link in the logical link database (see Hansen, column 13, lines 37 - 39).

As per claim 11, which is dependent on claim 9, Hansen teaches the method of claim 9. Hansen fails to teach wherein the processing system determine local interface and next neighbor information for the network device.

Lam teaches creating a new logical configuration link when connection information is not associated with any of the logical configuration links in the logical link database and storing the new logical configuration link in the logical link database (see Lam, column 9, lines 1 - 6).

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Lam with the method of Hansen in order to provide an up-to-date interface to the user.

As per claim 12-16, they all recite limitation that are addressed in the rejection for claim 1-8 and are rejected in the same rationale as they rejected in claim 1-8. Supra.

Response to Argument

Applicant's arguments filed on 2/2/05 have been fully considered but they are not persuasive.

Applicant's arguments focused on the following:

a) Lam fails to teach "creating a new logical configuration link when the local interface and next neighbor information is not associated wit any of the logical configuration links in the logical link database."

a) Examiner disagrees. Lam teaches creating a subnet network connection or a logical configuration link when it is missing from the trail database. (col. 8, lines 52-64) The missing subnet network connection is the connection between the local interface and next neighbor information because during the construction of the connection, the learning trail is in fact creating a connection point with the neighboring sub-network. (col. 9, lines 20-53)

b) Hansen could not validate the new logical configuration link.

b) Examiner disagrees. Although Hansen fails to teach creating a new logical configuration link, Hansen is not prevented from validate the logical configuration link once the linked is created using Lam's method.

c) Hansen fails to teach a plurality of logical configuration links in a logical link database.

c) Examiner disagrees. The examiner does not agree for the following reasons:

During patent examination, the pending claims must be "given >their< broadest reasonable interpretation consistent with the specification." > In re Hyatt, 211 F.3d 1367, 1372, 54 USPQ2d 1664, 1667 (Fed. Cir. 2000). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Applicant always has the opportunity to amend the claims during prosecution, and broad interpretation by the examiner reduces the possibility that the claim, once issued, will be

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Peng Ke

Kristine Kincaid
KRISTINE KINCAID
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2100

IFW 2174

PTO/SB/21 (09-04)
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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	10/027,821
Filing Date	12-19-2001
First Named Inventor	Denis Proulx, et al.
Art Unit	2174
Examiner Name	Ke, Peng
Attorney Docket Number	1400.1374890

Total Number of Pages in This Submission: 15

ENCLOSURES (Check all that apply)

- [x] Fee Transmittal Form
  - [x] Fee Attached
- [x] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [x] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/ Incomplete Application
  - [ ] Reply to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) ______
  - [ ] Landscape Table on CD
- [ ] After Allowance Communication to TC
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to TC (Appeal Notice, Brief, Reply Brief)
- [ ] Proprietary Information
- [ ] Status Letter
- [x] Other Enclosure(s) (please Identify below):
  Return Receipt Postcard

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	Ross D. Snyder & Associates, Inc.		
Signature	Ross D. Snyder		
Printed name	Ross D. Snyder		
Date	11-18-2005	Reg. No.	37,730

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature	Ross D. Snyder		
Typed or printed name	Ross D. Snyder, Reg. No. 37,730	Date	11-18-2005

PTO/SB/17 (12-04v2)
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Effective on 12/08/2004.
Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2005

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 1,020.00

Complete if Known	
Application Number	10/027,821
Filing Date	12-19-2001
First Named Inventor	Denis Proulx, et al.
Examiner Name	Ke, Peng
Art Unit	2174
Attorney Docket No.	1400.1374890

METHOD OF PAYMENT (check all that apply)

☑ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): ____________

☑ Deposit Account Deposit Account Number: 50-1566 Deposit Account Name: Ross D. Snyder & Assoc.

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☐ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, except for the filing fee

☑ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 ☑ Credit any overpayments

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

Application Type	FILING FEES Fee ($)	Small Entity Fee ($)	SEARCH FEES Fee ($)	Small Entity Fee ($)	EXAMINATION FEES Fee ($)	Small Entity Fee ($)	Fees Paid ($)
Utility	300	150	500	250	200	100	
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 (including Reissues)	50	25
Each independent claim over 3 (including Reissues)	200	100
Multiple dependent claims	360	180

Total Claims ______ - 20 or HP = ______ Extra Claims x ______ Fee ($) = ______ Fee Paid ($)

HP = highest number of total claims paid for, if greater than 20.

Indep. Claims ______ - 3 or HP = ______ Extra Claims x ______ Fee ($) = ______ Fee Paid ($)

HP = highest number of independent claims paid for, if greater than 3.

Multiple Dependent Claims: Fee ($) ______ Fee Paid ($) ______

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets ______ - 100 = ______ Extra Sheets / 50 = ______ Number of each additional 50 or fraction thereof (round up to a whole number) x ______ Fee ($) = ______ Fee Paid ($)

4. OTHER FEE(S) Fees Paid ($)

Non-English Specification, $130 fee (no small entity discount) ______

Other (e.g., late filing surcharge): Extension Fee 1,020.00

SUBMITTED BY			
Signature	*[signature]*	Registration No. (Attorney/Agent) 37,730	Telephone 512-347-9223
Name (Print/Type)	Ross D. Snyder		Date 11-18-2005

PTO/SB/22 (12-04)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARMENT OF COMMERCE

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a) FY 2005 *(Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).)*	Docket Number (Optional) 1400.1374890
Application Number 10/027,821	Filed 12-19-2001
For METHOD AND SYSTEM FOR IP LINK MANAGEMENT	
Art Unit 2174	Examiner Ke, Peng

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

	Fee	Small Entity Fee	
☐ One month (37 CFR 1.17(a)(1))	$120	$60	$____
☐ Two months (37 CFR 1.17(a)(2))	$450	$225	$____
☒ Three months (37 CFR 1.17(a)(3))	$1020	$510	$ 1,020.00
☐ Four months (37 CFR 1.17(a)(4))	$1590	$795	$____
☐ Five months (37 CFR 1.17(a)(5))	$2160	$1080	$____

☐ Applicant claims small entity status. See 37 CFR 1.27.

11/25/2005 HWOLDGE1 00000004 10027821
01 FC:1253 1020.00 OP

☒ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 50-1566. I have enclosed a duplicate copy of this sheet.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the ☐ applicant/inventor.

☐ assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) is enclosed (Form PTO/SB/96).

☒ attorney or agent of record. Registration Number 37,730

☐ attorney or agent under 37 CFR 1.34.
Registration number if acting under 37 CFR 1.34 ____

Ross D. Snyder (signature) — Signature

11-18-2005 — Date

Ross D. Snyder, Reg. No. 37,730 — Typed or printed name

(512) 347-9223 — Telephone Number

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.

☐ Total of ____ forms are submitted.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Denis Proulx, et al.

Title: METHOD AND SYSTEM FOR IP LINK MANAGEMENT

App. No.: 10/027,821 Filed: 12-19-2001

Examiner: Ke, Peng Group Art Unit: 2174

Atty. Dkt. No. 1400.1374890

Mail Stop Amendment
Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

RESPONSE

Dear Sir:

In response to the Office action of May 18, 2005, please amend the above-identified application as follows:

In the Specification:

Please delete the paragraph found on page 5, line 23, through page 6, line 3, of the specification and replace it with the following paragraph:

The configuration of large networks changes frequently due to addition, removal and/or replacement of network devices. To effectively manage large networks such that IP packets are routed correctly over the network, the network manager must know when data forwarding network devices are added or removed. One system used to discover network devices with data forwarding capabilities is described in U.S. Patent Application No. [[__________]] 10/029,124, filed December 19, 2001, titled "Method and Apparatus for Automatic Discovery of Network Devices with Data Forwarding Capabilities," assigned to the assignee of the present invention and incorporated by reference herein.

Please delete the paragraph found on page 6, line 19, through page 7, line 2, of the specification and replace it with the following paragraph:

In addition to knowing the identity and physical configuration of the network devices themselves, it is also important for the network manager to be able to monitor logical connections between network devices. A logical connection exists between network devices when at least one port of a first network device is configured so that a message sent out through that port would arrive at a known destination (either a network address or a second network device). The destination may be a particular port or interface on another network device, a particular IP address, or a particular subnetwork. One system used to discover logical links between network devices is described in U.S. Patent Application No. [[__________]] 10/029,123, filed December 19, 2001, titled "Method and Apparatus for Automatic Discovery of Logical Links between Network Devices," assigned to the assignee of the present invention, and incorporated by reference herein.

Please delete the paragraph found on page 25, lines 1-14, of the specification and replace it with the following paragraph:

An IP Link can be created via the embodied NMS GUI manually, by SNMP IP Link trap for some routers, or by the auto-discovery process (per co-pending Application No. [[________]] 10/029,123, "Method and Apparatus for Automatic Discovery of Logical Links between Network Devices"). An example of an IP link provisioning GUI window according to at least one embodiment of the present invention is shown in Figure 4, and generally designated example GUI window 400. GUI window 400 typifies what a user would see for provisioning a new point-to-point IP link by opening the New->Link->IP Link->Point-to-Point configuration form (not illustrated). A window title 405 appears at the top of the form to indicate the purpose of the window. The user may select the Link Numbering Type (Numbered or Unnumbered) with Link Numbering Type selection button 407. Link Numbering Type selection button 407 has "Numbered" selected in the example of Figure 4. The user may also select the Link Application (IP Forwarding, IP Forwarding and MPLS, or MPLS) with the Link Application selection button 408. In the same manner, the Link Sub layer Interface (ATM, POS, GigEthernet) may be selected with the Link Sub Layer Interface selection button 409.

REMARKS/ARGUMENTS

Claims 1-16 are pending in the application. The Examiner has rejected claims 1-16. Applicant respectfully requests reconsideration of pending claims 1-16.

In response to the previous Office action, Applicant submitted amendments to the specification to include identifying information (e.g., application numbers, filing date) of co-pending applications referenced in the specification. However, Applicant notes certain indications (e.g., underlining, double square brackets) appear not to have printed properly. Thus, Applicant resubmits the previously submitted amendments to the specification in a form that includes such indications. Applicant submits no new matter has been added and the omission of the indications in the previous response was inadvertent.

The Examiner has rejected claims 9 and 10 under 35 U.S.C. § 102(e) as being anticipated by Hansen, U.S. Patent No. 6,772,204. Applicant respectfully disagrees.

Regarding claim 9, Applicant submits the cited reference fails to disclose the features of claim 9. For example, while the Examiner previously acknowledged, "Hansen does not teach a logical link database for storing logical configuration links," the Examiner now alleges Hansen teaches such, citing column 13, lines 40-48, and stating, "It is inherent there is a database for storing a list of available connection interface overlayed on the network configuration map." While the Examiner asserts a rejection based on inherency, Applicant submits that the teachings of the cited reference fail to establish inherency in accordance with existing law. For example, Applicant submits that the Examiner has failed to establish that the public gained the benefit of the subject matter recited in claim 9 from the teachings of the cited reference. *Schering Corp. v. Geneva Pharmaceuticals*, 339 F.3d 1373 (Fed. Cir. 2003). As another example, Applicant submits that the Examiner has failed to establish that the subject matter recited in claim 9 is present in the teachings of the cited reference. *Mentor v. Medical Device Alliance*, 244 F.3d 1365 (Fed. Cir. 2001); *Scaltech v. Retec/Tetra*, 178 F.3d 1378 (Fed. Cir. 1999). Thus, Applicant submits that the subject matter recited in claim 9 cannot be considered to be inherent in the teachings of the cited reference. Accordingly, Applicant submits the Examiner has failed to satisfy the burden of proof required for asserting a rejection based on inherency. Therefore, Applicant submits that the Examiner has not shown claim 9 to be anticipated by the cited reference. Consequently, Applicant submits claim 9 is in condition for allowance.

Regarding claim 10, Applicant submits the cited reference fails to disclose the features of claim 10. For example, claim 10 depends from claim 9, and Applicant has presented reasons for the allowability of claim 9. Thus, Applicant submits claim 10 is also in condition for allowance.

The Examiner has rejected claims 1-8 and 11-16 under 35 U.S.C. § 103(a) as being unpatentable over Hansen, U.S. Patent No. 6,772,204 in view of Lam et al., U.S. Patent No. 6,381,237. Applicant respectfully disagrees.

Regarding claim 1, the Examiner acknowledges, "Hansen does not teach creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database and storing the new logical configuration link in the logical link database," but alleges that Lam does, citing column 9, lines 1-6, of Lam. In the Examiner's Response to Arguments, the Examiner alleges, "Lam teaches creating a subnet network connection or a logical configuration link when it is missing from the trail database. (col. 8, lines 52-64) The missing subnet network connection is the connection between the local interface and next neighbor information because during the construction of the connection, the learning trail is in fact creating a connection point with the neighboring sub-network. (col. 9, lines 20-53)." Applicant respectfully disagrees.

Applicant submits the cited portions of Hansen and Lam, taken either alone or in combination, fail to render obvious the features of claim 1. For example, Applicant submits the cited portions of Hansen and Lam do not render obvious "creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database." In column 8, lines 52-53, of Lam, as cited by the Examiner, Lam states, in part, "...when an SNC is found only in the network 10 and missing from the trail database 50,...." In column 9, line 38, of Lam, as cited by the Examiner, Lam states, "Finally, the trail learner 48 creates a link connection 92...." As apparently depicted in Fig. 10 of Lam, Applicant submits SNC's, such as SNC1 and SNC2 appear to be distinct from link connection 92. Thus, Applicant submits Lam appears to fail to provide teachings consistent with "determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database; creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database; [and] storing the new logical configuration link in the logical link database."

As one example, Applicant submits Lam appears to teach creating something different from that which it stores. As another example, Applicant notes, based on Fig. 10 of Lam, SNCs of Lam appear not to enable "determining whether the local interface and next neighbor information is associated with a logical configuration link stored among the plurality of logical configuration links in a logical link database." Thus, Applicant submits the teachings of the cited portions of the Hansen and Lam references cannot be combined to yield the features set forth in claim 1. Moreover, Applicant submits the apparent inconsistency of the teachings of the cited portions of Hansen and Lam vis à vis the features of claim 1 impair the Examiner's alleged motivation to combine the alleged teachings of the cited portions of the Hansen and Lam references.

Also, as noted previously, Applicant notes that the Examiner asserts that Hansen teaches "validating the new logical configuration link," "sending the new logical configuration link to the network device," and "displaying a graphical representation of the new logical configuration link on a display device," yet the Examiner acknowledges, "Hansen does not teach creating a new logical configuration link...." Applicant submits that Hansen's acknowledged failure to disclose "creating a new logical configuration link..." impairs the Examiner's argument that Hansen teaches "validating the new logical configuration link," "sending the new logical configuration link to the network device," and "displaying a graphical representation of the new logical configuration link on a display device." While the Examiner states, in the Examiner's Response to Arguments, "Although Hansen fails to teach creating a new logical configuration link, Hansen is not prevented from validate the logical configuration link one the linked is created using Lam's method," Applicant notes the apparent inconsistency of the teachings of the cited portions of the Hansen and Lam references, as discussed above, and the apparent tenuousness of alleging that a reference teaches validating a new logical configuration link while admitting that the same reference fails to teach creating the new logical configuration link.

In the Examiner's Response to Arguments, the Examiner also states, "Hansen teaches this limitation because "a list of available connection interface overlayed on the network configuration map" is a plurality of configuration links in a logical link database," citing column 13, lines 40-48. Applicant notes claim 1 recites, "determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database." Applicant submits the Examiner's alleged teaching in

Hansen of "a plurality of configuration links in a logical link database" blurs any distinction of what the Examiner would allege to be "the local interface" and "the plurality of logical configuration links in a logical link database." Thus, Applicant submits the Examiner's interpretation of the teachings of the Hansen reference cannot be reconciled with the features recited in claim 1.

In the Examiner's Response to Arguments, the Examiner also states, "The examiner interprets determining connectivity in a network to be the same as determining local interface and neighbor information for the network device," citing column 10, lines 62-66, which state, in part, "The trail explorer...may not only explore connectivity...." Applicant submits a mere reference to "explore connectivity" fails to disclose the features "determining local interface and next neighbor information for the network device," as the cited portion does not appear to disclose "local interface," "next neighbor information," or "network device." For the foregoing reasons, Applicant submits claim 1 is in condition for allowance.

Regarding claim 2, the Examiner appears to allege the same teachings based on the same portions of the same references as in the previous Office action. Applicant reiterates Applicant's previous arguments for the allowability of claim 2. Thus, Applicant submits claim 2 is in condition for allowance.

Regarding claim 3, the Examiner acknowledges, "Hansen does not selecting the link type from among a group consisting of: point-to-point, point-to-IP, and point-to-subnet." The Examiner asserts "official notice that point-to-IP and point-to-subnet link types are notoriously well known in the art of computer networks." Applicant respectfully disagrees and traverses the Examiner's alleged official notice. Applicant submits the Examiner has not presented evidence that such features would have been well known in the art at the time the invention was made. Thus, Applicant submits claim 3 is in condition for allowance.

Regarding claim 4, the Examiner acknowledges, "Hansen does not teach selecting the link numbering type from a group consisting of: a numbered type and an unnumbered type." The Examiner asserts "official notice that the unnumbered link numbering type is notoriously well known in the art of computer networks." Applicant respectfully disagrees and traverses the Examiner's alleged official notice. Applicant submits the Examiner has not presented evidence that such feature

would have been well known in the art at the time the invention was made. Thus, Applicant submits claim 4 is in condition for allowance.

Regarding claim 5, the Examiner acknowledges, "Hansen does not teach the method of claim 2, wherein the step of selecting a link application further comprises the step of: selecting the link application from a group consisting of: Internet Protocol Forwarding, Multiprotocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching." The Examiner asserts "official notice that Internet Protocol Forwarding, Multiprotocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching are notoriously well known in the art of computer networks." Applicant respectfully disagrees and traverses the Examiner's alleged official notice. Applicant submits the Examiner has not presented evidence that such features would have been well known in the art at the time the invention was made. Thus, Applicant submits claim 5 is in condition for allowance.

Regarding claim 6, the Examiner acknowledges, "Hansen does not teach the method of claim 2, wherein the step of selecting a sub layer interface type further comprises the step of: selecting the sub layer interface type from a group consisting of: Packet Over Sonet, Asynchronous Transfer Mode, and GigEthernet." The Examiner asserts "official notice that Packet Over Sonet, Asynchronous Transfer Mode, and GigEthernet are notoriously well known in the art of computer networks." Applicant respectfully disagrees and traverses the Examiner's alleged official notice. Applicant submits the Examiner has not presented evidence that such features would have been well known in the art at the time the invention was made. Thus, Applicant submits claim 6 is in condition for allowance.

Regarding claim 7, the Examiner acknowledges, "Hansen does not teach the method of claim 1, further comprising the step of: modifying a logical configuration link in the logical link database," but asserts that Lam does, citing column 10, lines 8-15, of Lam. Applicant has already noted the apparent inconsistency of the teachings of Lam et al. with the features recited in claim 1, from which claim 7 depends. In light of such apparent inconsistency, Applicant further submits that "update the trail database 50" of Lam et al., as described in column 10, lines 8-15, fails to disclose "modifying a logical configuration link in the logical link database," as recited in claim 7. Thus, Applicant submits that claim 7 is in condition for allowance.

Regarding claim 8, the Examiner asserts that Hansen teaches "deleting a logical configuration link the logical link database" in column 13, lines 37-39. Applicant has already noted the apparent failure of Hansen to disclose the features recited in claim 1, from which claim 8 depends. In light of such apparent failure, Applicant further submits that "proposed connection is then deleted" of Hansen, as described in column 13, line 37, fails to disclose "deleting a logical configuration link in the logical link database," as recited in claim 8. For example, Hansen recites a "*proposed* connection," not "a logical configuration link." Moreover, Applicant can find no mention in the cited portion of Hansen of "in the logical link database." Thus, Applicant submits that claim 8 is in condition for allowance.

Regarding claim 11, the Examiner acknowledges, "Hansen fails to teach wherein the processing system determine local interface and next neighbor information for the network device." The Examiner asserts, "Lam teaches creating a new logical configuration link when connection information is not associated with any of the logical configuration links in the logical link database and storing the new logical configuration link in the logical link database," citing column 9, lines 1-6, of Lam. However, Applicant notes the Examiner does not appear to allege that Lam teaches "wherein the processing system determines local interface and next neighbor information for the network device." Thus, Applicant submits the Examiner has not presented any rationale to support rejection of claim 11, and, even if an attempt were made to combine the teachings of Hansen and Lam, such attempt would not yield the features recited in claim 11. Therefore, Applicant submits claim 11 is in condition for allowance.

Regarding claims 12-16, the Examiner states, "they all recite limitation that are addressed in the rejection for claim 1-8 and are rejected in the same rationale as they rejected in claim 1-8." Applicant has presented reasons for the allowability of claims 1-8. To whatever extent the Examiner relies on the same rationale for rejecting claims 12-16, Applicant reiterates Applicant's arguments presented above regarding such rationale. Thus, Applicant submits claims 12-16 are in condition for allowance.

In conclusion, Applicant has overcome all of the Office's rejections, and early notice of allowance to this effect is earnestly solicited. If, for any reason, the Office is unable to allow the Application on the next Office Action, and believes a telephone interview would be helpful, the Examiner is respectfully requested to contact the undersigned attorney.

Respectfully submitted,

11/18/2005
Date

Ross D. Snyder, Reg. No. 37,730
Attorney for Applicant(s)
Ross D. Snyder & Associates, Inc.
PO Box 164075
Austin, Texas 78716-4075
(512) 347-9223 (phone)
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Notice of Non-Compliant Amendment (37 CFR 1.121)	Application No. 10/027,821	Applicant(s) PROULX ET AL.
	Examiner Peng Ke	Art Unit 2174

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

The amendment document filed on 11/23/05 is considered non-compliant because it has failed to meet the requirements of 37 CFR 1.121 or 1.4. In order for the amendment document to be compliant, correction of the following item(s) is required.

THE FOLLOWING MARKED (X) ITEM(S) CAUSE THE AMENDMENT DOCUMENT TO BE NON-COMPLIANT:

☐ 1. Amendments to the specification:
- ☐ A. Amended paragraph(s) do not include markings.
- ☐ B. New paragraph(s) should not be underlined.
- ☐ C. Other _____.

☐ 2. Abstract:
- ☐ A. Not presented on a separate sheet. 37 CFR 1.72.
- ☐ B. Other _____.

☐ 3. Amendments to the drawings:
- ☐ A. The drawings are not properly identified in the top margin as "Replacement Sheet," "New Sheet," or "Annotated Sheet" as required by 37 CFR 1.121(d).
- ☐ B. The practice of submitting proposed drawing correction has been eliminated. Replacement drawings showing amended figures, without markings, in compliance with 37 CFR 1.84 are required.
- ☐ C. Other _____.

☒ 4. Amendments to the claims:
- ☒ A. A complete listing of all of the claims is not present.
- ☐ B. The listing of claims does not include the text of all pending claims (including withdrawn claims)
- ☐ C. Each claim has not been provided with the proper status identifier, and as such, the individual status of each claim cannot be identified. Note: the status of every claim must be indicated after its claim number by using one of the following status identifiers: (Original), (Currently amended), (Canceled), (Previously presented), (New), (Not entered), (Withdrawn) and (Withdrawn-currently amended).
- ☐ D. The claims of this amendment paper have not been presented in ascending numerical order.
- ☐ E. Other: _____.

☐ 5. Other (e.g., the amendment is unsigned or not signed in accordance with 37 CFR 1.4):

_____

For further explanation of the amendment format required by 37 CFR 1.121, see MPEP § 714.

TIME PERIODS FOR FILING A REPLY TO THIS NOTICE:

1. Applicant is given **no new time period** if the non-compliant amendment is an after-final amendment or an amendment filed after allowance. If applicant wishes to resubmit the non-compliant after-final amendment with corrections, the **entire corrected amendment** must be resubmitted.

2. Applicant is given **one month**, or **thirty (30) days**, whichever is longer, from the mail date of this notice to supply the correction, if the non-compliant amendment is one of the following: a preliminary amendment, a non-final amendment (including a submission for a request for continued examination (RCE) under 37 CFR 1.114), a supplemental amendment filed within a suspension period under 37 CFR 1.103(a) or (c), and an amendment filed in response to a *Quayle* action. If any of above boxes 1. to 4. are checked, the correction required is only the **corrected section** of the non-compliant amendment in compliance with 37 CFR 1.121.

   Extensions of time are available under 37 CFR 1.136(a) only if the non-compliant amendment is a non-final amendment or an amendment filed in response to a *Quayle* action.

   Failure to timely respond to this notice will result in:
   Abandonment of the application if the non-compliant amendment is a non-final amendment or an amendment filed in response to a *Quayle* action; or
   Non-entry of the amendment if the non-compliant amendment is a preliminary amendment or supplemental amendment.

Legal Instruments Examiner (LIE), if applicable

571 272 4062
Telephone No.

Gp2174 IFW

OIPE IAP35 JUL 19 2006 PATENT & TRADEMARK OFFICE

PTO/SB/21 (09-04)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	10/027,821
Filing Date	12-19-2001
First Named Inventor	Denis Proulx, et al.
Art Unit	2174
Examiner Name	Ke, Peng
Attorney Docket Number	1400.1374890
Total Number of Pages in This Submission	19

ENCLOSURES *(Check all that apply)*

- [x] Fee Transmittal Form
  - [x] Fee Attached
- [x] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [x] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/ Incomplete Application
  - [ ] Reply to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) ________
  - [ ] Landscape Table on CD
- [ ] After Allowance Communication to TC
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to TC (Appeal Notice, Brief, Reply Brief)
- [ ] Proprietary Information
- [ ] Status Letter
- [x] Other Enclosure(s) (please Identify below):
  Return Receipt Postcard

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	Ross D. Snyder & Associates, Inc.		
Signature	Ross D. Snyder		
Printed name	Ross D. Snyder		
Date	07-16-2006	Reg. No.	37,730

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature	Ross D. Snyder		
Typed or printed name	Ross D. Snyder, Reg. No. 37,730	Date	07-16-2006

PTO/SB/22 (12-04)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARMENT OF COMMERCE
Under the paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a) FY 2005 *(Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).)*	Docket Number (Optional) 1400.1374890
Application Number 10/027,821	Filed 12-19-2001
For METHOD AND SYSTEM FOR IP LINK MANAGEMENT	
Art Unit 2174	Examiner Ke, Peng

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

	Fee	Small Entity Fee	
☐ One month (37 CFR 1.17(a)(1))	$120	$60	$
☐ Two months (37 CFR 1.17(a)(2))	$450	$225	$
☒ Three months (37 CFR 1.17(a)(3))	$1020	$510	$ 1,020.00
☐ Four months (37 CFR 1.17(a)(4))	$1590	$795	$
☐ Five months (37 CFR 1.17(a)(5))	$2160	$1080	$

☐ Applicant claims small entity status. See 37 CFR 1.27.

☒ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 50-1566. I have enclosed a duplicate copy of this sheet.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the
☐ applicant/inventor.
☐ assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) is enclosed (Form PTO/SB/96).
☒ attorney or agent of record. Registration Number 37,730
☐ attorney or agent under 37 CFR 1.34.
Registration number if acting under 37 CFR 1.34 ________

Ross D. Snyder (signature) — Signature
07-16-2006 — Date

Ross D. Snyder, Reg. No. 37,730 — Typed or printed name
(512) 347-9223 — Telephone Number

07/19/2006 HTECKLU1 00000001 10027821
01 FC:1253 1020.00 OP

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.

☐ Total of ________ forms are submitted.

PTO/SB/17 (12-04v2)
Approved for use through 07/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

OIPE IAP JUL 1 9 2006 PATENT & TRADEMARK OFFICE

Effective on 12/08/2004.
Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL For FY 2005

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 1,020.00

Complete if Known	
Application Number	10/027,821
Filing Date	12-19-2001
First Named Inventor	Denis Proulx, et al.
Examiner Name	Ke, Peng
Art Unit	2174
Attorney Docket No.	1400.1374890

METHOD OF PAYMENT (check all that apply)

☑ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): ____________

☑ Deposit Account Deposit Account Number: 50-1566 Deposit Account Name: Ross D. Snyder & Assoc.

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☐ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, except for the filing fee

☑ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 ☑ Credit any overpayments

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

	FILING FEES		SEARCH FEES		EXAMINATION FEES		
Application Type	Fee ($)	Small Entity Fee ($)	Fee ($)	Small Entity Fee ($)	Fee ($)	Small Entity Fee ($)	Fees Paid ($)
Utility	300	150	500	250	200	100	
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 (including Reissues)	50	25
Each independent claim over 3 (including Reissues)	200	100
Multiple dependent claims	360	180

Total Claims ______ - 20 or HP = Extra Claims ______ x Fee ($) ______ = Fee Paid ($) ______

HP = highest number of total claims paid for, if greater than 20.

Indep. Claims ______ - 3 or HP = Extra Claims ______ x Fee ($) ______ = Fee Paid ($) ______

HP = highest number of independent claims paid for, if greater than 3.

Multiple Dependent Claims: Fee ($) ______ Fee Paid ($) ______

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets ______ - 100 = Extra Sheets ______ / 50 = Number of each additional 50 or fraction thereof ______ (round up to a whole number) x Fee ($) ______ = Fee Paid ($) ______

4. OTHER FEE(S) Fees Paid ($)

Non-English Specification, $130 fee (no small entity discount) ______

Other (e.g., late filing surcharge): Extension Fee 1,020.00

SUBMITTED BY

Signature	Ross D. Snyder	Registration No. (Attorney/Agent) 37,730	Telephone 512-347-9223
Name (Print/Type)	Ross D. Snyder		Date 07-16-2006

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Denis Proulx, et al.

Title: METHOD AND SYSTEM FOR IP LINK MANAGEMENT

App. No.: 10/027,821 Filed: 12-19-2001

Examiner: Ke, Peng Group Art Unit: 2174

Atty. Dkt. No. 1400.1374890

Mail Stop Amendment
Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

RESPONSE

Dear Sir:

In response to the Office action of May 18, 2005 and further in response to the Notice of Non-Compliant Amendment (37 CFR 1.121), please amend the above-identified application as follows:

In the Specification:

Please delete the paragraph found on page 5, line 23, through page 6, line 3, of the specification and replace it with the following paragraph:

The configuration of large networks changes frequently due to addition, removal and/or replacement of network devices. To effectively manage large networks such that IP packets are routed correctly over the network, the network manager must know when data forwarding network devices are added or removed. One system used to discover network devices with data forwarding capabilities is described in U.S. Patent Application No. [[__________]] 10/029,124, filed December 19, 2001, titled "Method and Apparatus for Automatic Discovery of Network Devices with Data Forwarding Capabilities," assigned to the assignee of the present invention and incorporated by reference herein.

Please delete the paragraph found on page 6, line 19, through page 7, line 2, of the specification and replace it with the following paragraph:

In addition to knowing the identity and physical configuration of the network devices themselves, it is also important for the network manager to be able to monitor logical connections between network devices. A logical connection exists between network devices when at least one port of a first network device is configured so that a message sent out through that port would arrive at a known destination (either a network address or a second network device). The destination may be a particular port or interface on another network device, a particular IP address, or a particular subnetwork. One system used to discover logical links between network devices is described in U.S. Patent Application No. [[__________]] 10/029,123, filed December 19, 2001, titled "Method and Apparatus for Automatic Discovery of Logical Links between Network Devices," assigned to the assignee of the present invention, and incorporated by reference herein.

Please delete the paragraph found on page 25, lines 1-14, of the specification and replace it with the following paragraph:

An IP Link can be created via the embodied NMS GUI manually, by SNMP IP Link trap for some routers, or by the auto-discovery process (per co-pending Application No. [[________]] 10/029,123, "Method and Apparatus for Automatic Discovery of Logical Links between Network Devices"). An example of an IP link provisioning GUI window according to at least one embodiment of the present invention is shown in Figure 4, and generally designated example GUI window 400. GUI window 400 typifies what a user would see for provisioning a new point-to-point IP link by opening the New->Link->IP Link->Point-to-Point configuration form (not illustrated). A window title 405 appears at the top of the form to indicate the purpose of the window. The user may select the Link Numbering Type (Numbered or Unnumbered) with Link Numbering Type selection button 407. Link Numbering Type selection button 407 has "Numbered" selected in the example of Figure 4. The user may also select the Link Application (IP Forwarding, IP Forwarding and MPLS, or MPLS) with the Link Application selection button 408. In the same manner, the Link Sub layer Interface (ATM, POS, GigEthernet) may be selected with the Link Sub Layer Interface selection button 409.

In the Claims:

1. (Original) A network administration method for provisioning logical configuration links for at least two network devices through a dedicated graphical user interface form, the method comprising:

selecting a network device having at least one network interface through the dedicated graphical user interface form;

determining local interface and next neighbor information for the network device;

determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database;

creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database;

storing the new logical configuration link in the logical link database;

validating the new logical configuration link;

sending the new logical configuration link to the network device; and

displaying a graphical representation of the new logical configuration link on a display device.

2. (Original) The method of claim 1, wherein the step of creating a new logical configuration link further comprises the steps of:

selecting a link type;

selecting a link numbering type for the new logical configuration link;

selecting a link application for the new logical configuration link;

selecting a sub layer interface type for the new logical configuration link;

creating a first endpoint for the new logical configuration link; and

creating a second endpoint for the new logical configuration link.

3. (Original) The method of claim 2, wherein the step of selecting the link type further

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comprises the step of:

selecting the link type from among a group consisting of: point-to-point, point-to-IP, and point-to-subnet.

4. (Original) The method of claim 2, wherein the step of selecting a link numbering type further comprises the step of:

selecting the link numbering type from a group consisting of: a numbered type and an unnumbered type.

5. (Original) The method of claim 2, wherein the step of selecting a link application further comprises the step of:

selecting the link application from a group consisting of: Internet Protocol Forwarding, Multi-Protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching.

6. (Original) The method of claim 2, wherein the step of selecting a sub layer interface type further comprises the step of:

selecting the sub layer interface type from a group consisting of: Packet Over Sonet, Asynchronous Transfer Mode, and GigEthernet.

7. (Original) The method of claim 1, further comprising the step of:

modifying a logical configuration link in the logical link database.

8. (Original) The method of claim 1, further comprising the step of:

deleting a logical configuration link in the logical link database.

9. (Original) Apparatus for provisioning logical configuration links comprising:

a logical link database for storing logical configuration links;

a processing system coupled to the logical link database for accessing the logical link database; and

a display device coupled to the processing system for displaying a graphical user interface form comprising a graphical representation of a logical configuration link.

10. (Original) The apparatus of claim 9 wherein the display device provides an ability to select a network device having at least one network interface through the graphical user interface form.

11. (Original) The apparatus of claim 9 wherein the processing system determines local interface and next neighbor information for the network device.

12. (Original) The apparatus of claim 11 wherein the processing system determines whether the local interface and next neighbor information is associated with one of the logical configuration links stored in the logical link database.

13. (Original) The apparatus of claim 12 wherein the processing system creates a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links stored in the logical link database.

14. (Original) The apparatus of claim 13 wherein the processing system causes the new logical configuration link to be stored in the logical link database.

15. (Original) The apparatus of claim 14 wherein the processing system validates the new logical configuration link.

16. (Original) The apparatus of claim 15 wherein the processing system causes the new logical configuration link to be sent to the network device.

REMARKS/ARGUMENTS

The Examiner has issued a Notice of Non-Compliant Amendment (37 CFR 1.121), stating as follows:

THE FOLLOWING MARKED (X) ITEM(S) CAUSE THE AMENDMENT DOCUMENT TO BE NON-COMPLIANT:

4. Amendments to the claims:

A. A complete listing of all of the claims is not present.

Applicant quotes 37 CFR 1.121(c), in relevant part, as follows:

(c) Claims. ...Each amendment document **that includes a change to an existing claim, cancellation of an existing claim or addition of a new claim**, must include a complete listing of all claims ever presented, including the text of all pending and withdrawn claims, in the application.... [emphasis added]

Applicant notes that not only was there no "change to an existing claim, cancellation of an existing claim or addition of a new claim" in the response for which the Examiner issued the Notice of Non-Compliant Amendment (37 CFR 1.121), but there was no "change to an existing claim, cancellation of an existing claim or addition of a new claim" in response to the previous Office action. Moreover, Applicant notes there has been no "change to an existing claim, cancellation of an existing claim or addition of a new claim" since the application was originally filed. Accordingly, pursuant to 37 CFR 1.121(c), Applicant submits no "complete listing of all of the claims" need be presented and further that the previously filed response for which the Examiner issued the Notice of Non-Compliant Amendment (37 CFR 1.121) was complete, proper, and fully compliant with 37 CFR 1.121 when and as filed. Applicant further submits the Notice of Non-Compliant Amendment (37 CFR 1.121) was improperly issued, as Applicant submits no justification for its issuance exists. Accordingly, Applicant respectfully requests the Examiner rescind the Notice of Non-Compliant Amendment (37 CFR 1.121) and continue reconsideration of the pending application in view of the previously filed response. Moreover, Applicant petitions the Commissioner of Patents add the time lost due to the improper issuance of the Notice of Non-Compliant Amendment (37 CFR 1.121) to any patent term adjustment and/or patent term extension to any patent that may issue from the pending application. Applicant encloses herewith payment for an extension of time under 37 CFR 1.136(a) to respond to the improperly issued Notice of Non-Compliant Amendment (37 CFR 1.121). However, as Applicant submits Applicant's original response was fully compliant with 37 CFR 1.121, Applicant hereby requests a refund of the payment enclosed herewith. To comply with the Notice of Non-Compliant

Amendment (37 CFR 1.121) despite Applicant's protest as to the impropriety of the Notice, Applicant has amended this response to include a "complete listing of all of the claims." Applicant notes that all of the claims of the listing include the status identifier "(Original)" as all of the claims remain unchanged since the original filing of the present application. The "REMARKS/ARGUMENTS" of the previously filed response as set forth below:

Claims 1-16 are pending in the application. The Examiner has rejected claims 1-16. Applicant respectfully requests reconsideration of pending claims 1-16.

In response to the previous Office action, Applicant submitted amendments to the specification to include identifying information (e.g., application numbers, filing date) of co-pending applications referenced in the specification. However, Applicant notes certain indications (e.g., underlining, double square brackets) appear not to have printed properly. Thus, Applicant resubmits the previously submitted amendments to the specification in a form that includes such indications. Applicant submits no new matter has been added and the omission of the indications in the previous response was inadvertent.

The Examiner has rejected claims 9 and 10 under 35 U.S.C. § 102(e) as being anticipated by Hansen, U.S. Patent No. 6,772,204. Applicant respectfully disagrees.

Regarding claim 9, Applicant submits the cited reference fails to disclose the features of claim 9. For example, while the Examiner previously acknowledged, "Hansen does not teach a logical link database for storing logical configuration links," the Examiner now alleges Hansen teaches such, citing column 13, lines 40-48, and stating, "It is inherent there is a database for storing a list of available connection interface overlayed on the network configuration map." While the Examiner asserts a rejection based on inherency, Applicant submits that the teachings of the cited reference fail to establish inherency in accordance with existing law. For example, Applicant submits that the Examiner has failed to establish that the public gained the benefit of the subject matter recited in claim 9 from the teachings of the cited reference. *Schering Corp. v. Geneva Pharmaceuticals*, 339 F.3d 1373 (Fed. Cir. 2003). As another example, Applicant submits that the Examiner has failed to establish that the subject matter recited in claim 9 is present in the teachings of the cited reference. *Mentor v. Medical Device Alliance*, 244 F.3d 1365 (Fed. Cir. 2001); *Scaltech v. Retec/Tetra*, 178 F.3d 1378 (Fed. Cir. 1999). Thus, Applicant submits that the subject matter recited in claim 9 cannot be considered to

be inherent in the teachings of the cited reference. Accordingly, Applicant submits the Examiner has failed to satisfy the burden of proof required for asserting a rejection based on inherency. Therefore, Applicant submits that the Examiner has not shown claim 9 to be anticipated by the cited reference. Consequently, Applicant submits claim 9 is in condition for allowance.

Regarding claim 10, Applicant submits the cited reference fails to disclose the features of claim 10. For example, claim 10 depends from claim 9, and Applicant has presented reasons for the allowability of claim 9. Thus, Applicant submits claim 10 is also in condition for allowance.

The Examiner has rejected claims 1-8 and 11-16 under 35 U.S.C. § 103(a) as being unpatentable over Hansen, U.S. Patent No. 6,772,204 in view of Lam et al., U.S. Patent No. 6,381,237. Applicant respectfully disagrees.

Regarding claim 1, the Examiner acknowledges, "Hansen does not teach creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database and storing the new logical configuration link in the logical link database," but alleges that Lam does, citing column 9, lines 1-6, of Lam. In the Examiner's Response to Arguments, the Examiner alleges, "Lam teaches creating a subnet network connection or a logical configuration link when it is missing from the trail database. (col. 8, lines 52-64) The missing subnet network connection is the connection between the local interface and next neighbor information because during the construction of the connection, the learning trail is in fact creating a connection point with the neighboring sub-network. (col. 9, lines 20-53)." Applicant respectfully disagrees.

Applicant submits the cited portions of Hansen and Lam, taken either alone or in combination, fail to render obvious the features of claim 1. For example, Applicant submits the cited portions of Hansen and Lam do not render obvious "creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database." In column 8, lines 52-53, of Lam, as cited by the Examiner, Lam states, in part, "...when an SNC is found only in the network 10 and missing from the trail database 50,...." In column 9, line 38, of Lam, as cited by the Examiner, Lam states, "Finally, the trail learner 48 creates a link connection 92...." As apparently depicted in Fig. 10 of Lam, Applicant submits SNC's, such as SNC1 and SNC2 appear to be distinct from link connection 92. Thus, Applicant submits Lam appears

to fail to provide teachings consistent with "determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database; creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database; [and] storing the new logical configuration link in the logical link database." As one example, Applicant submits Lam appears to teach creating something different from that which it stores. As another example, Applicant notes, based on Fig. 10 of Lam, SNCs of Lam appear not to enable "determining whether the local interface and next neighbor information is associated with a logical configuration link stored among the plurality of logical configuration links in a logical link database." Thus, Applicant submits the teachings of the cited portions of the Hansen and Lam references cannot be combined to yield the features set forth in claim 1. Moreover, Applicant submits the apparent inconsistency of the teachings of the cited portions of Hansen and Lam vis à vis the features of claim 1 impair the Examiner's alleged motivation to combine the alleged teachings of the cited portions of the Hansen and Lam references.

Also, as noted previously, Applicant notes that the Examiner asserts that Hansen teaches "validating the new logical configuration link," "sending the new logical configuration link to the network device," and "displaying a graphical representation of the new logical configuration link on a display device," yet the Examiner acknowledges, "Hansen does not teach creating a new logical configuration link...." Applicant submits that Hansen's acknowledged failure to disclose "creating a new logical configuration link..." impairs the Examiner's argument that Hansen teaches "validating the new logical configuration link," "sending the new logical configuration link to the network device," and "displaying a graphical representation of the new logical configuration link on a display device." While the Examiner states, in the Examiner's Response to Arguments, "Although Hansen fails to teach creating a new logical configuration link, Hansen is not prevented from validate the logical configuration link one the linked is created using Lam's method," Applicant notes the apparent inconsistency of the teachings of the cited portions of the Hansen and Lam references, as discussed above, and the apparent tenuousness of alleging that a reference teaches validating a new logical configuration link while admitting that the same reference fails to teach creating the new logical configuration link.

In the Examiner's Response to Arguments, the Examiner also states, "Hansen teaches this limitation because "a list of available connection interface overlayed on the network configuration map" is a plurality of configuration links in a logical link database," citing column 13, lines 40-48. Applicant notes claim 1 recites, "determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database." Applicant submits the Examiner's alleged teaching in Hansen of "a plurality of configuration links in a logical link database" blurs any distinction of what the Examiner would allege to be "the local interface" and "the plurality of logical configuration links in a logical link database." Thus, Applicant submits the Examiner's interpretation of the teachings of the Hansen reference cannot be reconciled with the features recited in claim 1.

In the Examiner's Response to Arguments, the Examiner also states, "The examiner interprets determining connectivity in a network to be the same as determining local interface and neighbor information for the network device," citing column 10, lines 62-66, which state, in part, "The trail explorer...may not only explore connectivity...." Applicant submits a mere reference to "explore connectivity" fails to disclose the features "determining local interface and next neighbor information for the network device," as the cited portion does not appear to disclose "local interface," "next neighbor information," or "network device." For the foregoing reasons, Applicant submits claim 1 is in condition for allowance.

Regarding claim 2, the Examiner appears to allege the same teachings based on the same portions of the same references as in the previous Office action. Applicant reiterates Applicant's previous arguments for the allowability of claim 2. Thus, Applicant submits claim 2 is in condition for allowance.

Regarding claim 3, the Examiner acknowledges, "Hansen does not selecting the link type from among a group consisting of: point-to-point, point-to-IP, and point-to-subnet." The Examiner asserts "official notice that point-to-IP and point-to-subnet link types are notoriously well known in the art of computer networks." Applicant respectfully disagrees and traverses the Examiner's alleged official notice. Applicant submits the Examiner has not presented evidence that such features would have been well known in the art at the time the invention was made. Thus, Applicant submits claim 3 is in condition for allowance.

Regarding claim 4, the Examiner acknowledges, "Hansen does not teach selecting the link numbering type from a group consisting of: a numbered type and an unnumbered type." The Examiner asserts "official notice that the unnumbered link numbering type is notoriously well known in the art of computer networks." Applicant respectfully disagrees and traverses the Examiner's alleged official notice. Applicant submits the Examiner has not presented evidence that such feature would have been well known in the art at the time the invention was made. Thus, Applicant submits claim 4 is in condition for allowance.

Regarding claim 5, the Examiner acknowledges, "Hansen does not teach the method of claim 2, wherein the step of selecting a link application further comprises the step of: selecting the link application from a group consisting of: Internet Protocol Forwarding, Multiprotocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching." The Examiner asserts "official notice that Internet Protocol Forwarding, Multiprotocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching are notoriously well known in the art of computer networks." Applicant respectfully disagrees and traverses the Examiner's alleged official notice. Applicant submits the Examiner has not presented evidence that such features would have been well known in the art at the time the invention was made. Thus, Applicant submits claim 5 is in condition for allowance.

Regarding claim 6, the Examiner acknowledges, "Hansen does not teach the method of claim 2, wherein the step of selecting a sub layer interface type further comprises the step of: selecting the sub layer interface type from a group consisting of: Packet Over Sonet, Asynchronous Transfer Mode, and GigEthernet." The Examiner asserts "official notice that Packet Over Sonet, Asynchronous Transfer Mode, and GigEthernet are notoriously well known in the art of computer networks." Applicant respectfully disagrees and traverses the Examiner's alleged official notice. Applicant submits the Examiner has not presented evidence that such features would have been well known in the art at the time the invention was made. Thus, Applicant submits claim 6 is in condition for allowance.

Regarding claim 7, the Examiner acknowledges, "Hansen does not teach the method of claim 1, further comprising the step of: modifying a logical configuration link in the logical link database," but asserts that Lam does, citing column 10, lines 8-15, of Lam. Applicant has already noted the apparent inconsistency of the teachings of Lam et al. with the features recited in claim 1, from which claim 7 depends. In light of such apparent inconsistency, Applicant further submits that "update the trail

In conclusion, Applicant has overcome all of the Office's rejections, and early notice of allowance to this effect is earnestly solicited. If, for any reason, the Office is unable to allow the Application on the next Office Action, and believes a telephone interview would be helpful, the Examiner is respectfully requested to contact the undersigned attorney.

Respectfully submitted,

07/16/2006
Date

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EXAMINER	
KE, PENG	
ART UNIT	**PAPER NUMBER**
2174	

DATE MAILED: 10/23/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)
	10/027,821	PROULX ET AL.
	Examiner	Art Unit
	Peng Ke	2174

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 July 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-15* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-15* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

This action is responsive to communications: Amendment, filed on 7/19/06.

Claims 1-15 are pending in this application. Claims 1 and 9 are independent claims.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-4, and 7-15 are rejected under 35 U.S.C. 102(b) as being anticipated by Hansen US Patent 5,838,907.

As per claim 1, Hansen teaches a network administration method for provisioning logical configuration links for at least two network devices through a dedicated graphical user interface form, the method comprising:

Selecting a network device having at least one network interface through the dedicated graphical user interface form; (figure 3b, column 15, lines 18-32; To configure a device, the device must be selected first)

Determining local interface and next neighbor information for the network device; (figure 7, items 114, 116, 120, 126, 122, 118, and 124)

Determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database; (column 5, lines 35-65; Subsystem is a logical link database)

Creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical ink databases; (column 15, lines 30-50; Unconnected PCI slot are unassociated connection)

Storing the new logical configuration link in the logical link database; (column 13, lines 10-30)

Validating the new logical configuration link; (column 13, lines 10-30)

Sending the new logical configuration link to the network device; (column 14, lines 41-60) and

Displaying a graphical representation of the new logical configuration link on a display device. (column 14, lines 41-60)

As per claim 2, Hansen teaches the method of claim 1. Hansen further teaches the step of creating a new logical configuration lik further comprises the steps of;

Selecting a like type; (column 13, lines 1-10; x. 25, frame relay, PPP and HDLC are link types)

Selecting a link numbering type for the new logical configuration link; (column 11, lines 13-30; PCI slots are numbered configuration links)

Selecting a link application for the new logical configuration link; (column 14, lines 5-25; The script commands are applications; column 13, lines 65-column 14, lines 5)

Selecting a sub layer interface type for the new logical configuration link; (column 14, lines 15-25; Connection identifiers are configuration links)

Creating a first endpoint for the new logical configuration link; and

Creating a second endpoint for the new logical configuration link.(column 13, lines 10-30)

As per claim 3, Hansen teaches the method of claim 2, wherein the step of selecting the link type further comprises the step of:

Selecting the link type from among a group consisting of: point-to-point, point-to-IP, and pint-to-subnet. (column 13, lines 1-10; x. 25, frame relay, PPP and HDLC)

As per claim 4, Hansen teaches the method of claim 4, wherein the step of selecting the a link number type further comprises the step of:

Selecting the link numbering type from a group consisting of: a numbered type and an un-number type. (column 11, lines 13-30; PCI slots are numbering type, column 13, lines 28-45; a list of connection interface is un-number type)

As per claim 7, Hansen teaches the method of claim 1, Hansen further teaches the step of:

Modifying a logical configuration link in the logical link databases. (column 11, lines 41-53; Editing is modifying)

As per claim 8, Hansen teaches the method of claim 1, Hansen further teaches the step of:

Deleting a logical configuration link in the logical link database. (column 10, lines 1-20)

As per claim 9, it is of the same scope as claim 1. Supra.

As per claim 10, Hansen teaches the apparatus of claim 9. Hansen teaches wherein the display device provides an ability to select a network device having at least one network

interface through the graphical user interface form. (figure 3b, column 15, lines 18-32; To configure a device, the device must be selected first)

As per claim 11, Hansen teaches the apparatus of claim 9, Hansen further teaches the processing system determines local interface and next neighbor information for the network device. (figure 7, items 114, 116, 120, 126, 122, 118, and 124)

As per claim 12, Hansen teaches the apparatus of claim 11, Hansen further teaches the processing system determines whether the local interface and next neighbor information is associated with one of the logical configuration links stored in the logical link database. (column 15, lines 30-50; Unconnected PCI slot are unassociated connection)

As per claim 13, Hansen teaches the apparatus of claim 12, Hansen further teaches creates a new logical configuration link when the local interface and next neighbor information is not associate with any of the logical configuration links stored in the logical link database. (column 13, lines 10-30)

As per claim 14, Hansen teaches the apparatus of claim 13, Hansen further teaches the processing system causes the new logical configuration link to be stored in the logical link database. (column 13, lines 10-30)

As per claim 15, Hansen teaches the apparatus of claim 14, Hansen further teaches the processing system validates the new logical configuration link. (column 13, lines 10-30)

As per claim 16, Hansen teaches the apparatus of claim 15, Hansen further teaches the processing system cause the new logical configuration link to be sent to the network device. (column 14, lines 41-60)

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hansen in view of Hansen US Patent 5,838,907 in view of Hardwick US Patent 5,550,816.

As per claim 5, Hansen teaches the method of claim 2. Hansen fails to teach the step of selecting a link application from a group consisting of:

Internet Protocol Forwarding, Multi-Protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching.

Hardwick teaches the step of selecting a link application from a group consisting of:

Internet Protocol Forwarding, Multi-Protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching. (column 43, lines 60- column 44, lines 5)

It would have been obvious to an artisan at the time of the invention to include Hardwick's teaching with method of Hansen in order to provide a wide variety of access control tools that permit network managers to define the policy of how network group can interact within themselves.

Claims 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hansen in view of Hansen US Patent 5,838,907 in view of Chui US Patent 2002/0165978.

As per claim 6, Hansen teaches the method of claim 2, Hansen fails to teach selecting a sub layer interface type further comprises the step of :

Selecting the sub-layer interface type from a group consisting of; Packet over Sonet, Asynchronous Transfer Mode, and GigEthernet.

Chui teaches selecting a sub layer interface type further comprises the step of :

Selecting the sub-layer interface type from a group consisting of; Packet over Sonet, Asynchronous Transfer Mode, and GigEthernet. (Paragraph 0201)

It would have been obvious to an artisan at the time of the invention to include Chui's teaching with method of Hansen in order to provide a wide variety of access control tools that permit network managers to define the policy of how network group can interact within themselves.

Response To Argument

Applicant's arguments with respect to claims 1-15 have been considered but are deemed to be moot in view of the new grounds of rejection.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Peng Ke whose telephone number is (571) 272-4062. The examiner can normally be reached on M-Th and Alternate Fridays 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kristine L. Kincaid can be reached on (571) 272-4063. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Notice of References Cited	Application/Control No. 10/027,821	Applicant(s)/Patent Under Reexamination PROULX ET AL.	
	Examiner Peng Ke.	Art Unit 2174	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code*	Date MM-YYYY	Name	Classification
*	A	US-5,838,907	11-1998	Hansen, Peter A.	709/220
*	B	US-5,550,816	08-1996	Hardwick et al.	370/397
*	C	US-2002/0165978	11-2002	Chui, Terence	709/238
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

US005550816A

United States Patent [19]

Hardwick et al.

[11] Patent Number: 5,550,816

[45] Date of Patent: Aug. 27, 1996

[54] METHOD AND APPARATUS FOR VIRTUAL SWITCHING

[75] Inventors: Ken Hardwick, Sherwood, Oreg.; Geoffrey C. Stone, Minneapolis, Minn.

[73] Assignee: Storage Technology Corporation, Lousville, Colo.

[21] Appl. No.: 366,227

[22] Filed: Dec. 29, 1994

[51] Int. Cl.⁶ H04L 12/56; G06F 13/00

[52] U.S. Cl. 370/60; 370/85.13; 370/94.1; 395/650; 395/800; 395/200.02

[58] Field of Search 370/58.1, 58.2, 370/58.3, 60, 60.1, 61, 79, 85.13, 85.14, 94.1, 94.2, 94.3; 395/200, 325, 375, 650, 800, 500

[56] References Cited

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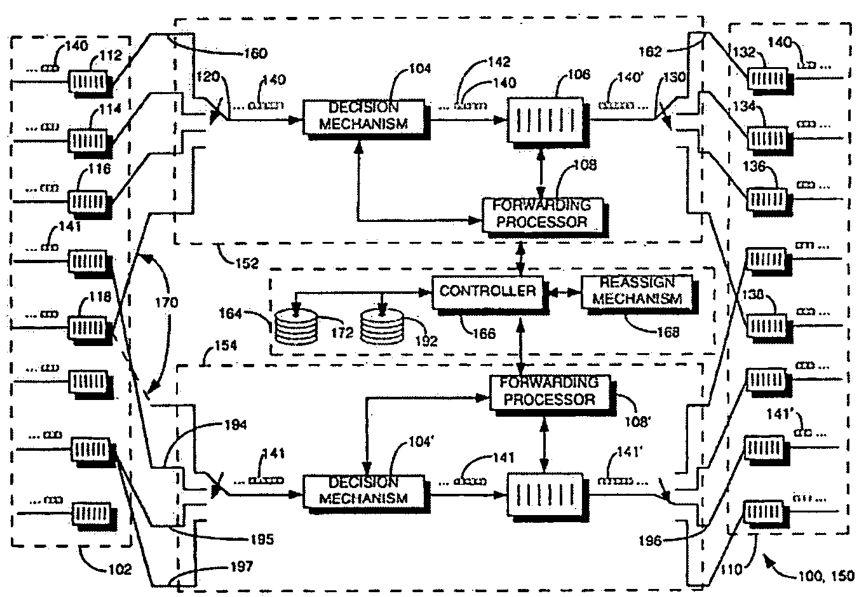
5,119,369	6/1992	Tanabe et al.	370/60
5,249,292	9/1993	Chiappa	395/650
5,278,834	1/1994	Mazzola	370/94.1
5,280,476	1/1994	Kojima et al.	370/60.1
5,317,568	5/1994	Bixby et al.	370/85.13
5,321,692	6/1994	Wallmeier	370/60
5,430,727	7/1995	Callon	370/85.13

Primary Examiner—Alpus H. Hsu
Attorney, Agent, or Firm—Timothy R. Schulte

[57] ABSTRACT

A physical switching device for use in a communication network to switch Open Systems Interconnection (OSI) network layer packets and method of use therefor is provided. The physical switching device includes at least a first and a second virtual switch. Each virtual switch includes a decision mechanism for determining an associated directive based on a destination identifier within a particular packet received at a data port. A processor is coupled to each virtual switch to insert the particular packet into an outgoing data stream on another data port to deliver the packet. Both data ports are associated with a plurality of data interfaces in the physical switching device. A management apparatus is coupled to each virtual switch to maintain information on an association between the plurality of data interfaces and the virtual switches. The management apparatus limits each processor to only inserting the particular packet on another data port associated with the same virtual switch which received the particular packet.

57 Claims, 35 Drawing Sheets



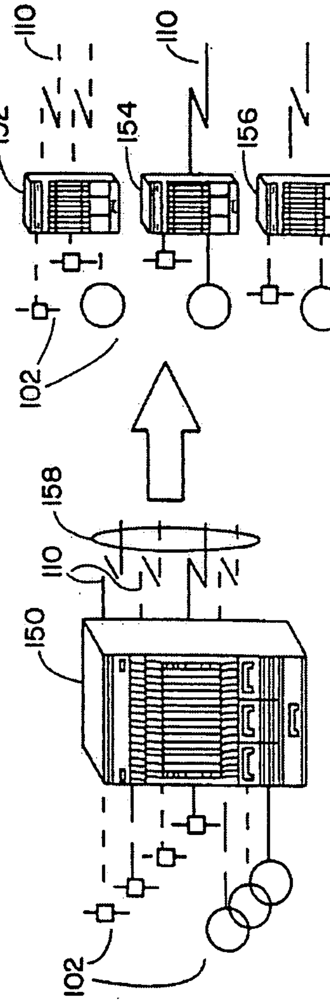

102
150
110
158
152
154
156
110
110
102

FIG. 1

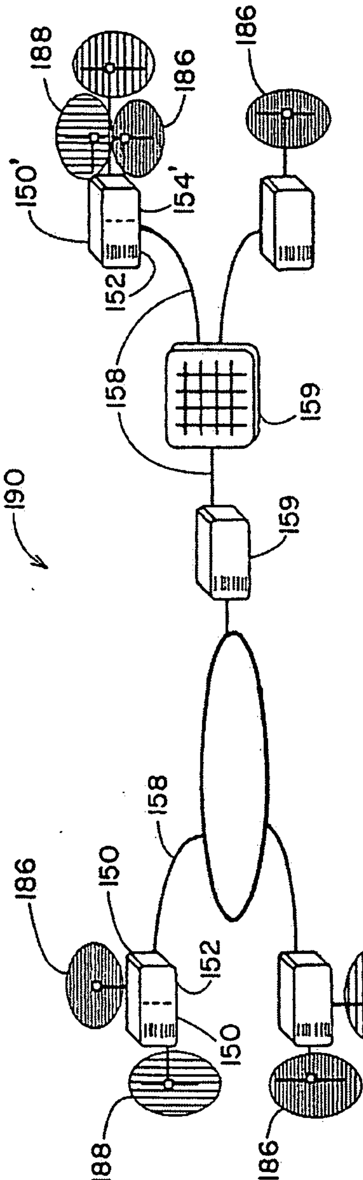

190
186
188
150
152
150
158
186
188
159
159
158
152
150'
154'
188
186
186

FIG. 4

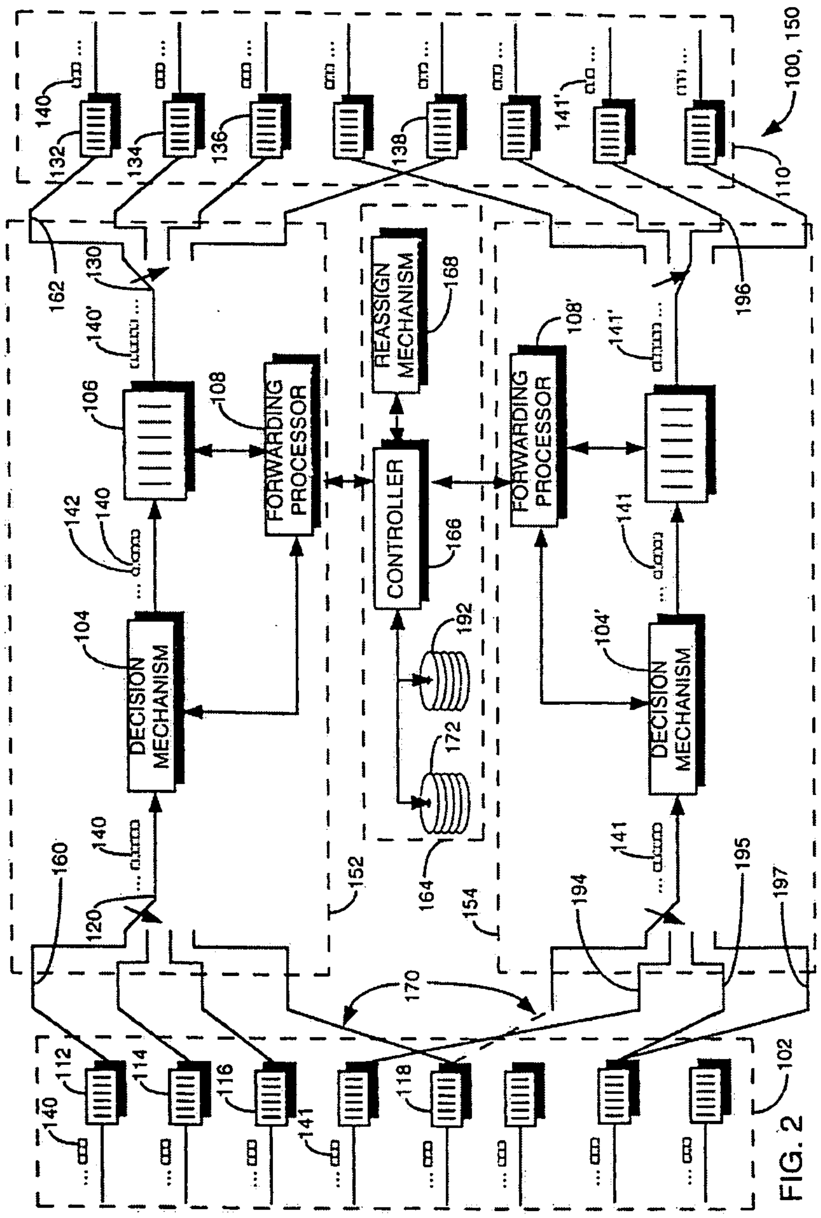

DECISION MECHANISM
FORWARDING PROCESSOR
CONTROLLER
REASSIGN MECHANISM
FORWARDING PROCESSOR
DECISION MECHANISM
100, 150
102
104
104'
106
108
108'
110
120
130
152
154
160
162
164
166
168
170
172
192
194
195
196
197

FIG. 2

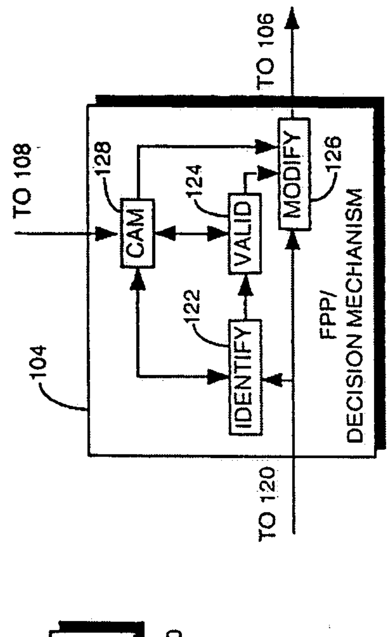

TO 108
TO 106
TO 120
104
128
124
122
126
CAM
VALID
IDENTIFY
MODIFY
FPP/
DECISION MECHANISM

FIG. 5

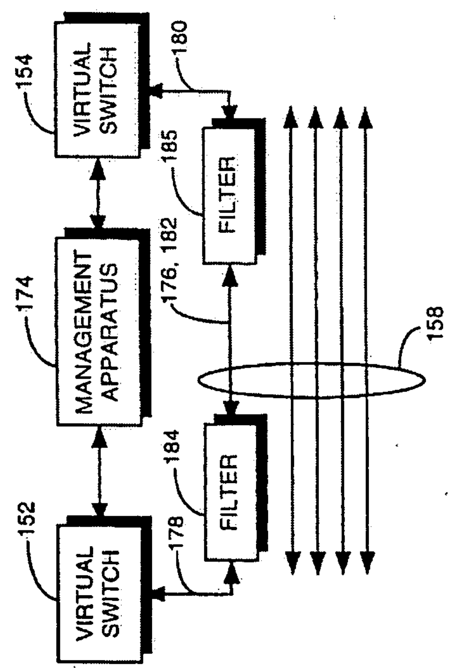

VIRTUAL SWITCH
MANAGEMENT APPARATUS
VIRTUAL SWITCH
FILTER
FILTER
154
174
152
180
185
176, 182
184
178
158

FIG. 3

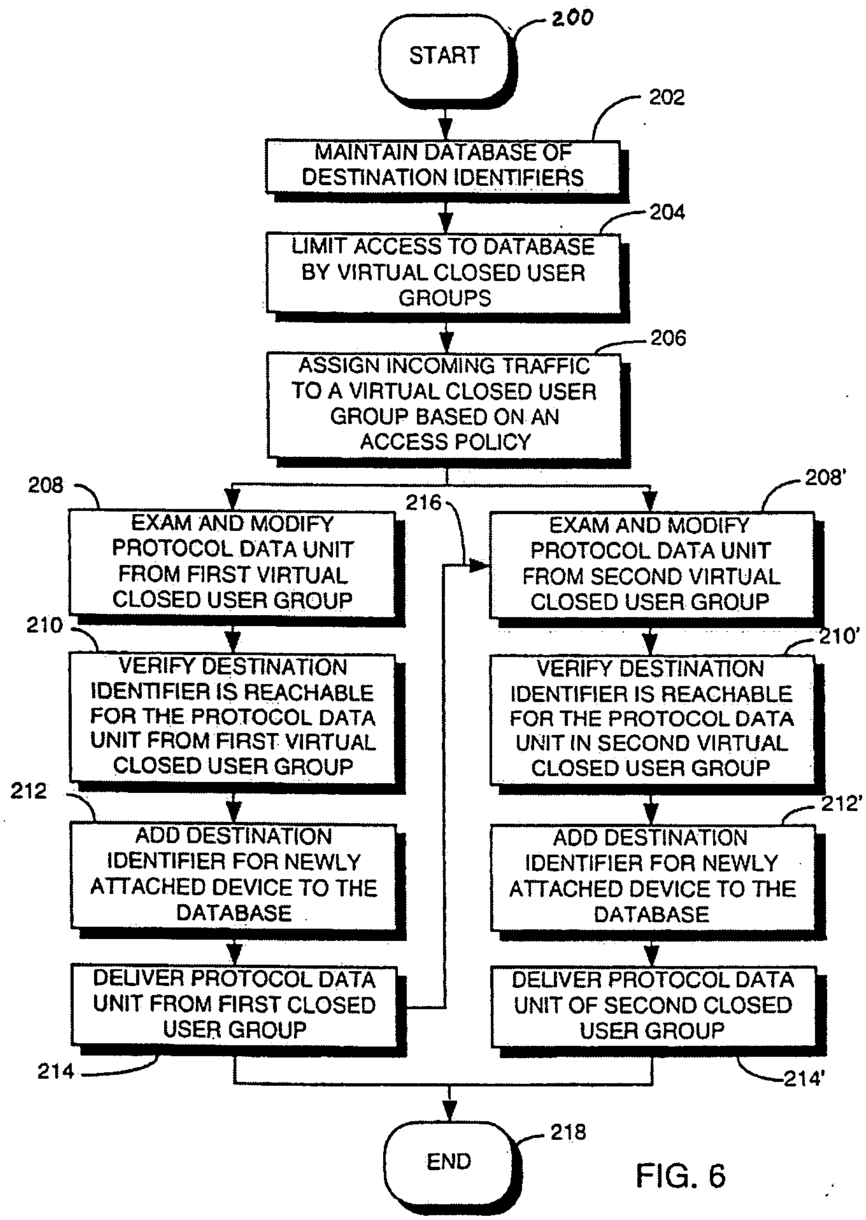

200
START
202
MAINTAIN DATABASE OF DESTINATION IDENTIFIERS
204
LIMIT ACCESS TO DATABASE BY VIRTUAL CLOSED USER GROUPS
206
ASSIGN INCOMING TRAFFIC TO A VIRTUAL CLOSED USER GROUP BASED ON AN ACCESS POLICY
208
EXAM AND MODIFY PROTOCOL DATA UNIT FROM FIRST VIRTUAL CLOSED USER GROUP
210
VERIFY DESTINATION IDENTIFIER IS REACHABLE FOR THE PROTOCOL DATA UNIT FROM FIRST VIRTUAL CLOSED USER GROUP
212
ADD DESTINATION IDENTIFIER FOR NEWLY ATTACHED DEVICE TO THE DATABASE
DELIVER PROTOCOL DATA UNIT FROM FIRST CLOSED USER GROUP
214
216
208'
EXAM AND MODIFY PROTOCOL DATA UNIT FROM SECOND VIRTUAL CLOSED USER GROUP
210'
VERIFY DESTINATION IDENTIFIER IS REACHABLE FOR THE PROTOCOL DATA UNIT IN SECOND VIRTUAL CLOSED USER GROUP
212'
ADD DESTINATION IDENTIFIER FOR NEWLY ATTACHED DEVICE TO THE DATABASE
DELIVER PROTOCOL DATA UNIT OF SECOND CLOSED USER GROUP
214'
218
END

FIG. 6

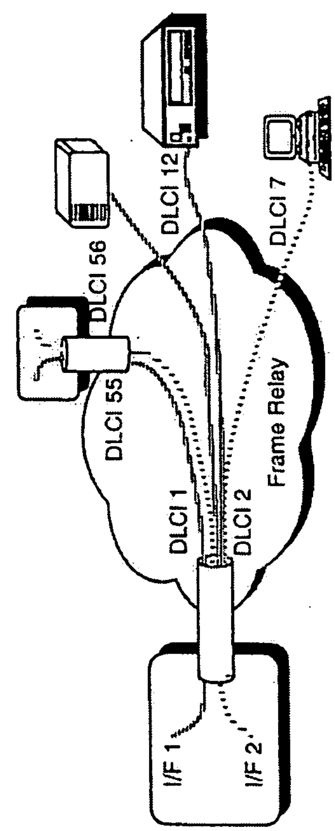

I/F 1
I/F 2
DLCI 1
DLCI 2
DLCI 55
DLCI 56
DLCI 12
DLCI 7
Frame Relay

FIG. 7

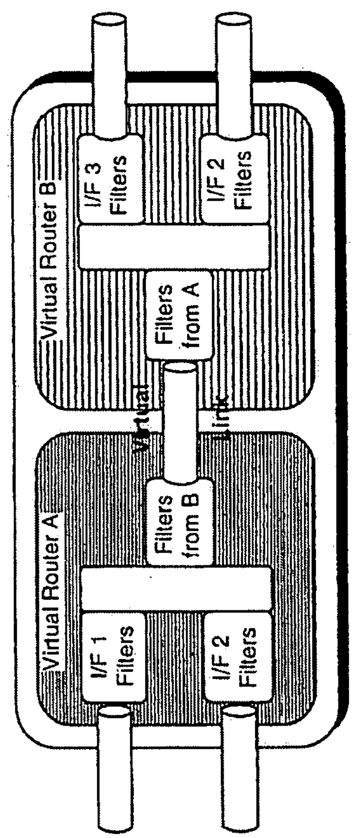

Virtual Router A
Virtual Router B
I/F 1 Filters
I/F 2 Filters
Filters from B
Filters from A
I/F 3 Filters
I/F 2 Filters
Virtual
Link

FIG. 8

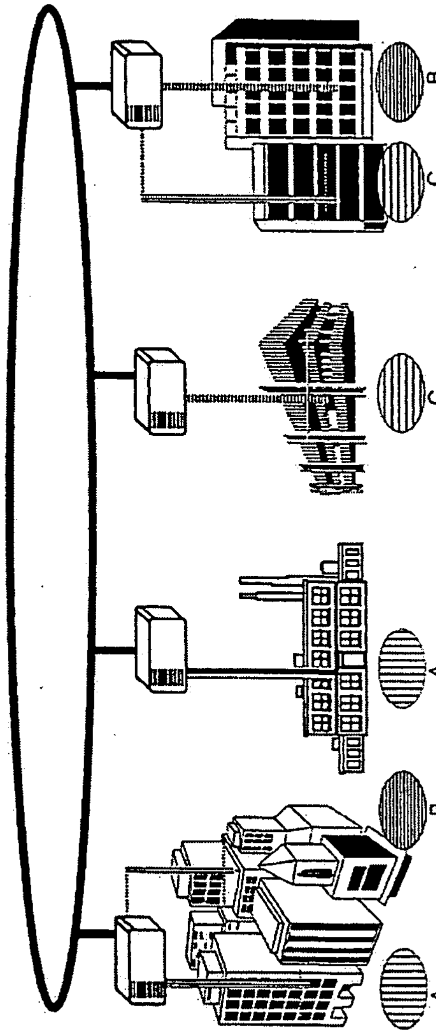


FIG. 9

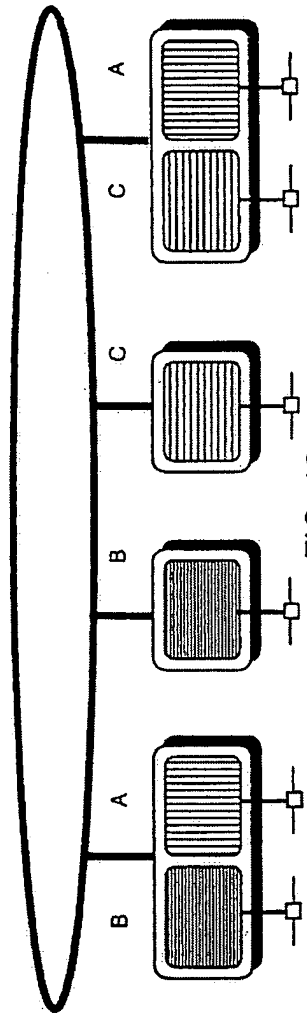


FIG. 10

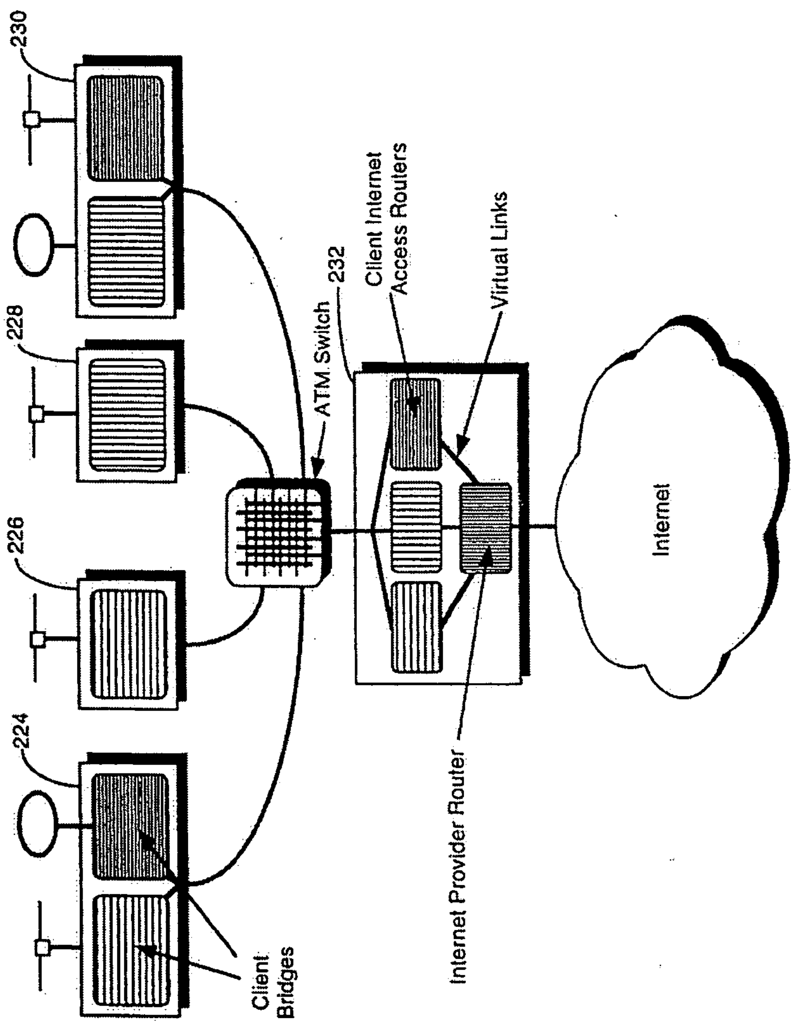

230
228
226
224
Client Internet
Access Routers
232
ATM Switch
Virtual Links
Internet
Internet Provider Router
Client
Bridges

FIG. 11

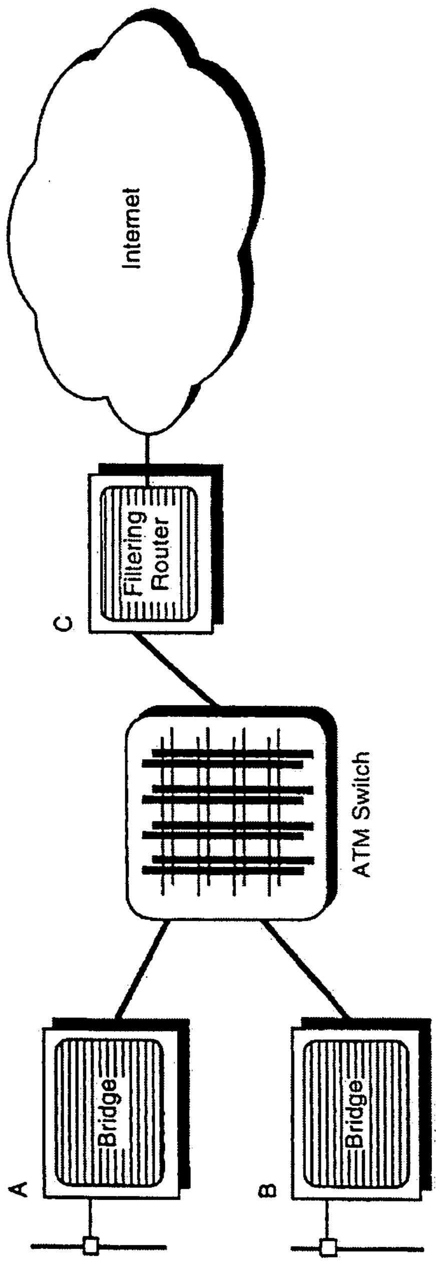


FIG. 12

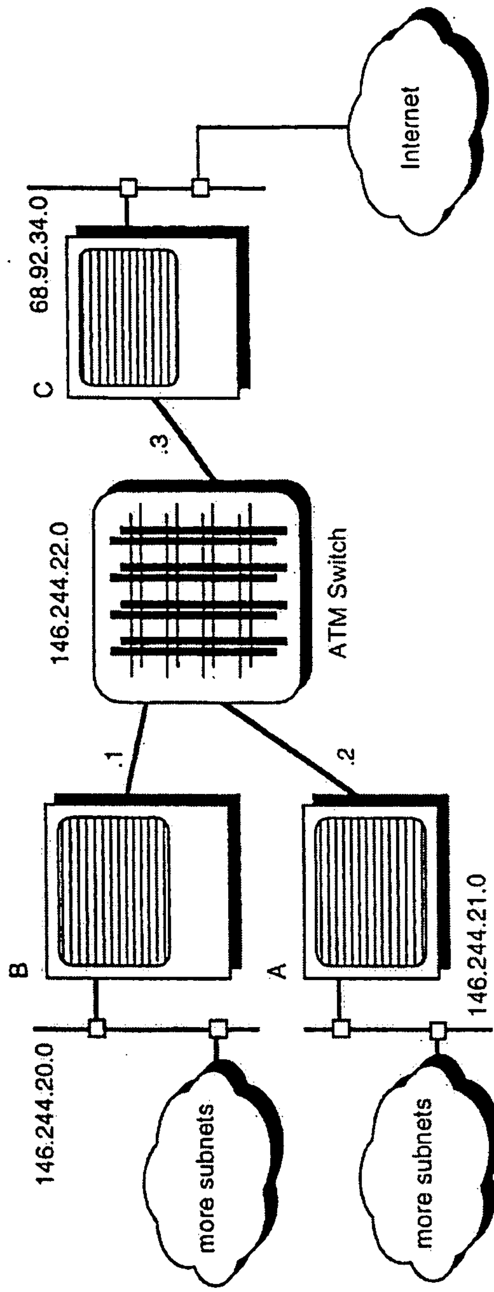

Internet
68.92.34.0
C
.3
146.244.22.0
ATM Switch
.1
.2
B
A
146.244.21.0
146.244.20.0
more subnets
more subnets

FIG. 13

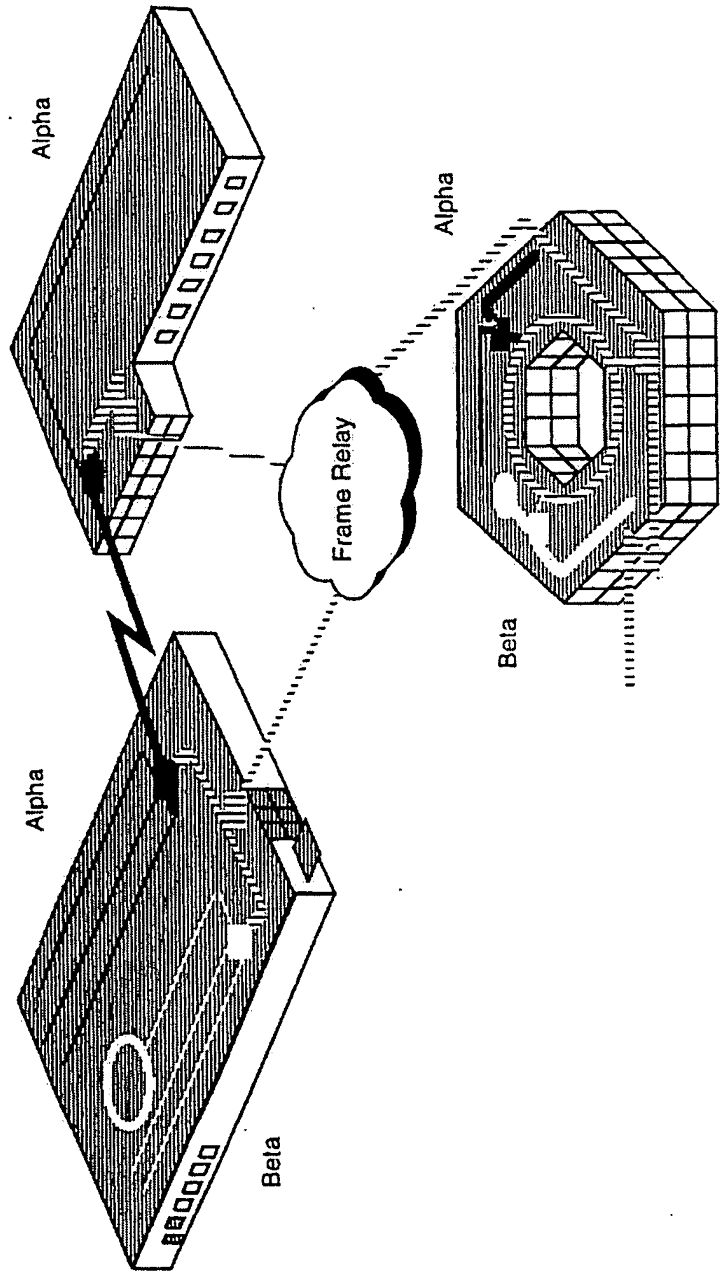


FIG. 14

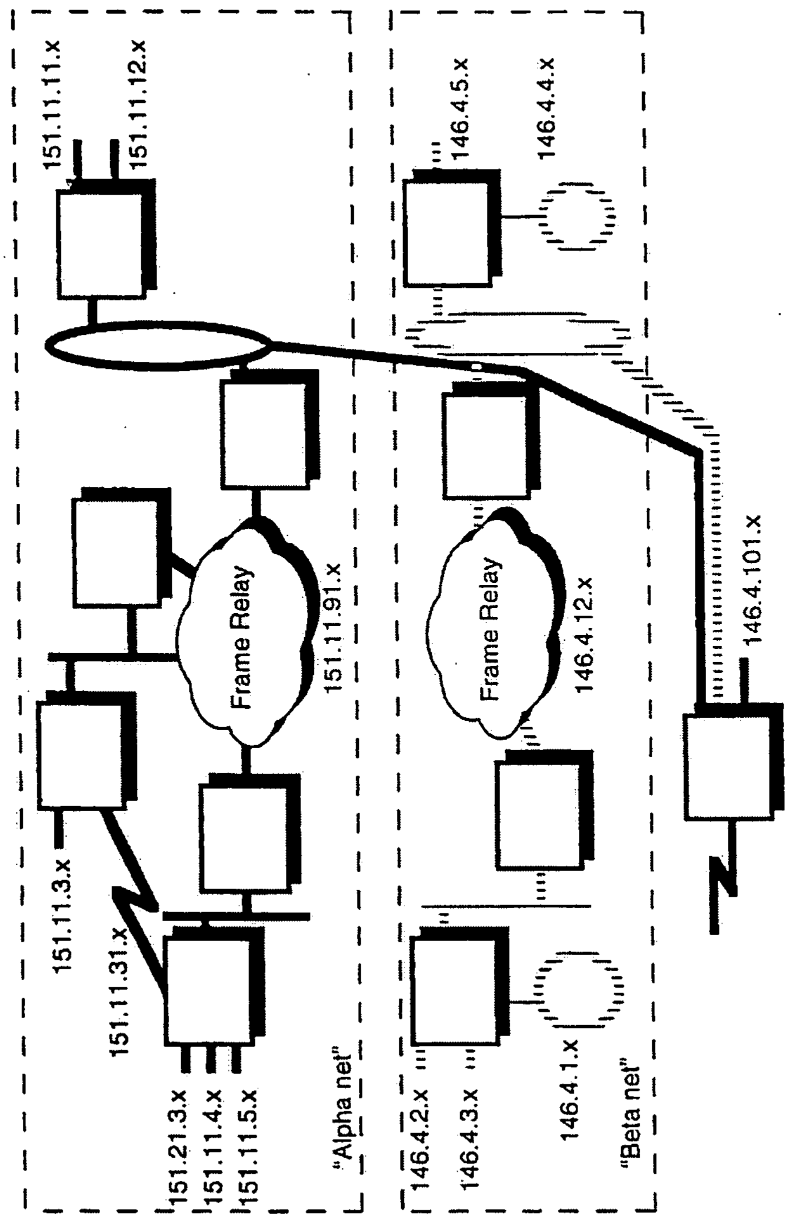

151.11.11.x
151.11.12.x
146.4.5.x
146.4.4.x
Frame Relay
151.11.91.x
Frame Relay
146.4.12.x
146.4.101.x
151.11.3.x
151.11.31.x
151.21.3.x
151.11.4.x
151.11.5.x
"Alpha net"
146.4.2.x
146.4.3.x
146.4.1.x
"Beta net"

FIG. 15

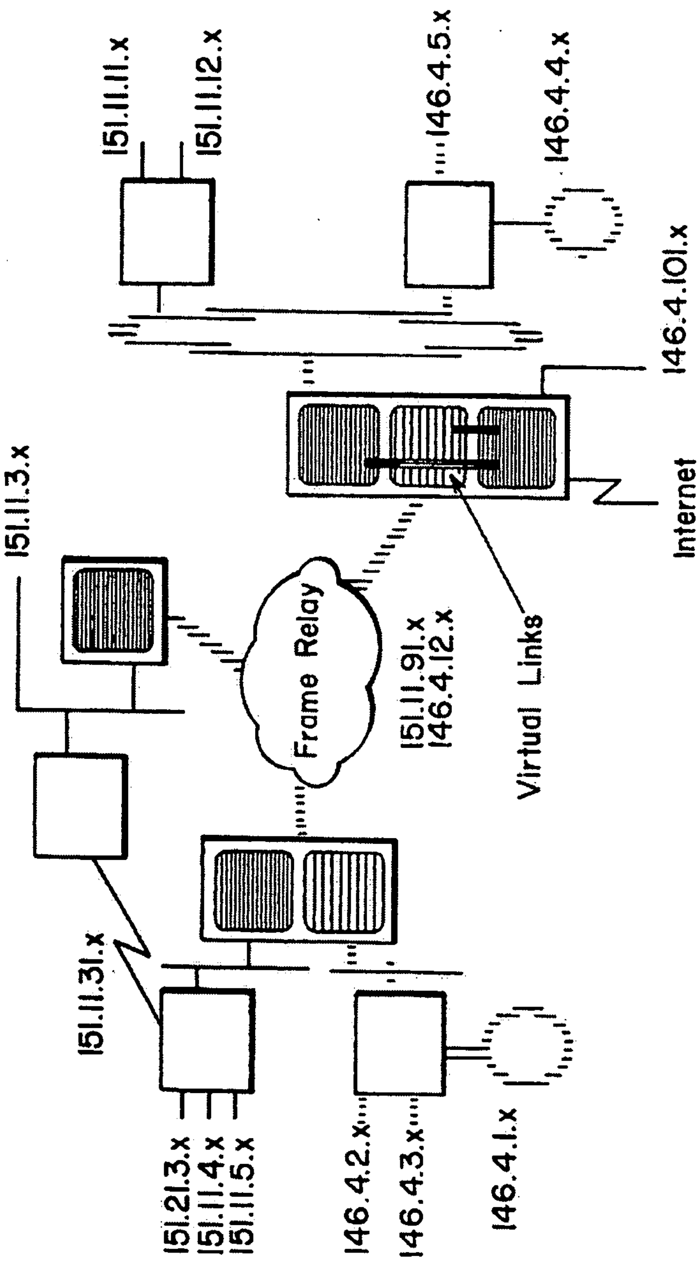

151.11.11.x
151.11.12.x
146.4.5.x
146.4.4.x
146.4.101.x
Internet
151.11.3.x
Frame Relay
151.11.91.x
146.4.12.x
Virtual Links
151.11.31.x
151.21.3.x
151.11.4.x
151.11.5.x
146.4.2.x
146.4.3.x
146.4.1.x

FIG. 16

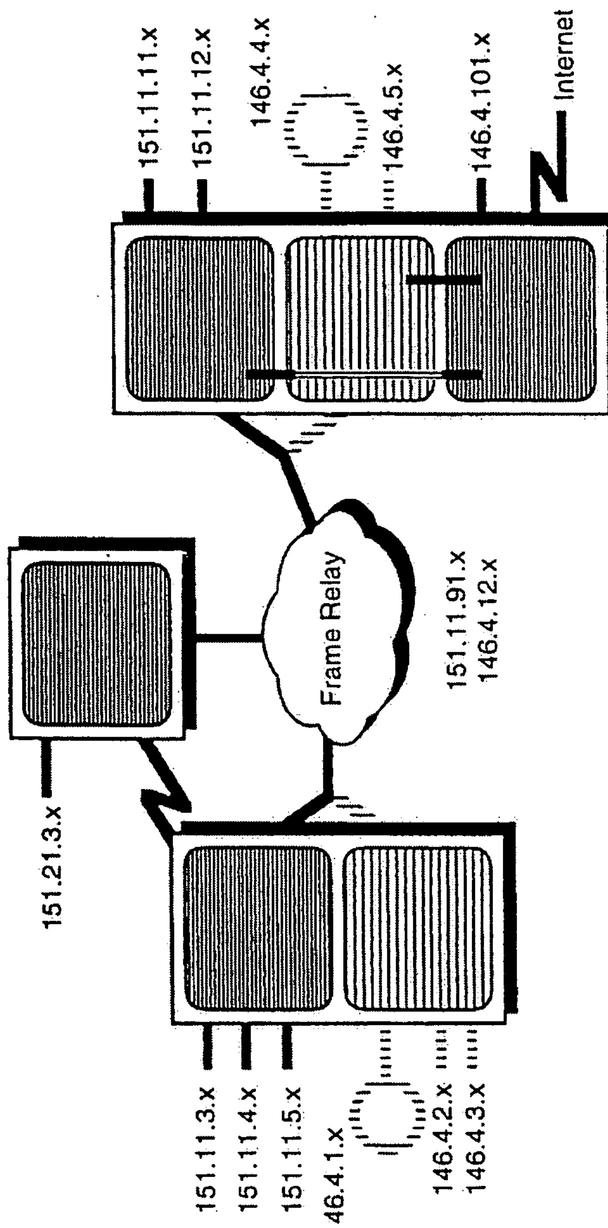

151.11.11.x
151.11.12.x
146.4.4.x
146.4.5.x
146.4.101.x
Internet
Frame Relay
151.11.91.x
146.4.12.x
151.21.3.x
151.11.3.x
151.11.4.x
151.11.5.x
146.4.1.x
146.4.2.x
146.4.3.x

FIG. 17

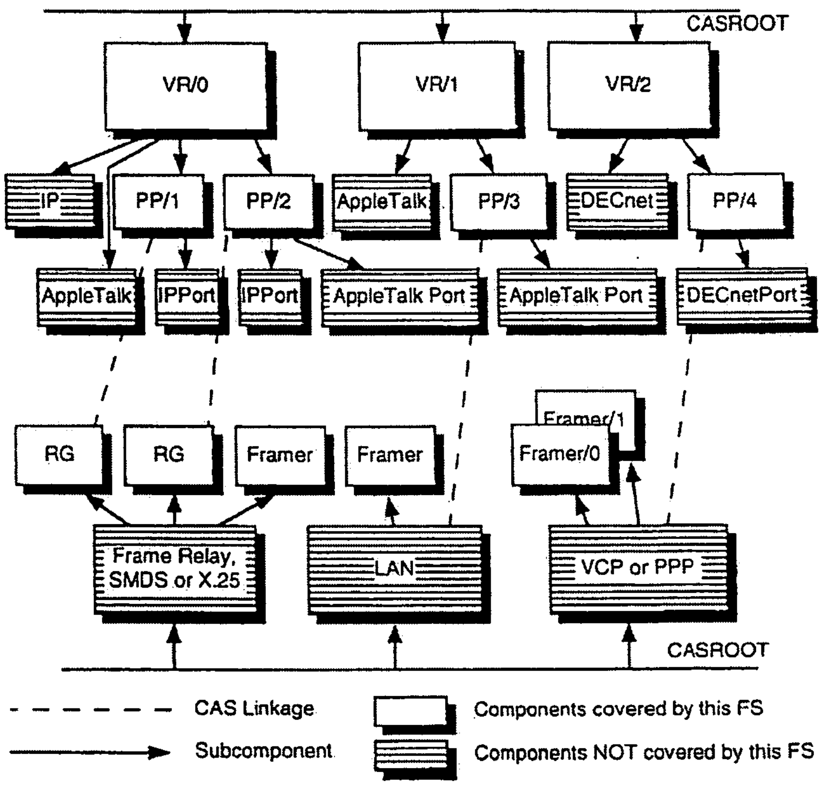

CASROOT
VR/0
VR/1
VR/2
IP
PP/1
PP/2
AppleTalk
PP/3
DECnet
PP/4
AppleTalk
IPPort
IPPort
AppleTalk Port
AppleTalk Port
DECnetPort
Framer/1
RG
RG
Framer
Framer
Framer/0
Frame Relay, SMDS or X.25
LAN
VCP or PPP
CASROOT
CAS Linkage
Subcomponent
Components covered by this FS
Components NOT covered by this FS

FIG. 18

205

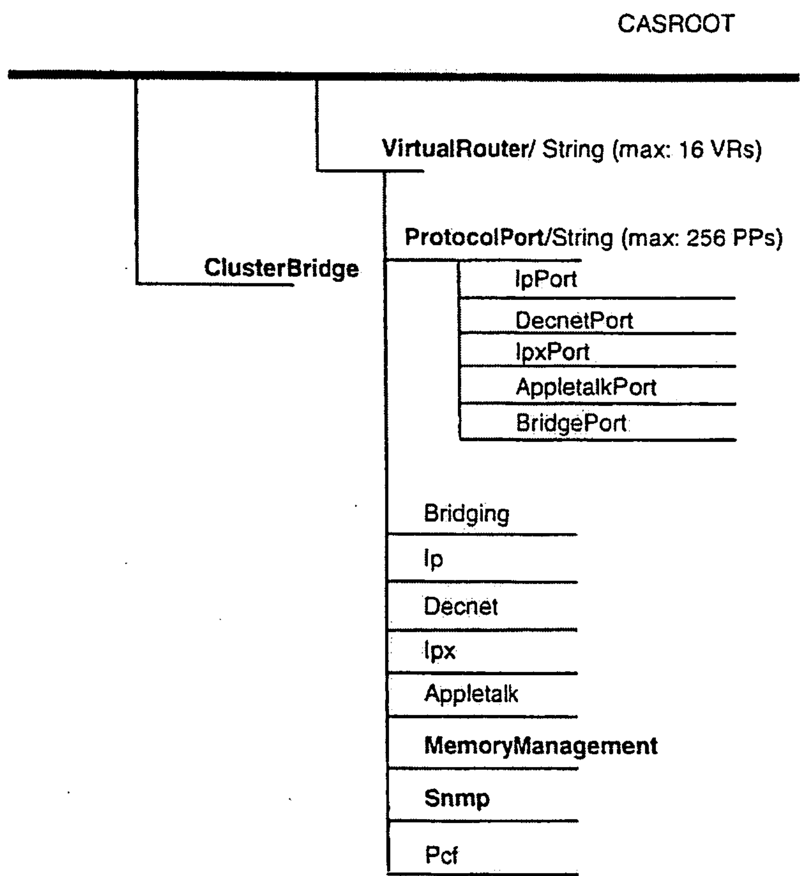

CASROOT
VirtualRouter/ String (max: 16 VRs)
ProtocolPort/String (max: 256 PPs)
ClusterBridge
IpPort
DecnetPort
IpxPort
AppletalkPort
BridgePort
Bridging
Ip
Decnet
Ipx
Appletalk
MemoryManagement
Snmp
Pcf

FIG. 19

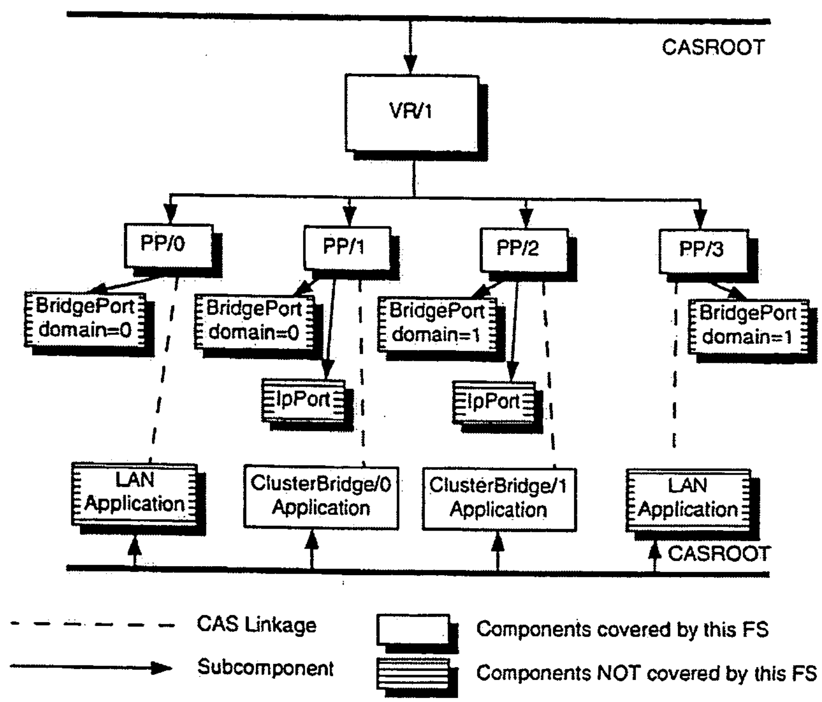

CASROOT
VR/1
PP/0
PP/1
PP/2
PP/3
BridgePort domain=0
BridgePort domain=0
BridgePort domain=1
BridgePort domain=1
IpPort
IpPort
LAN Application
ClusterBridge/0 Application
ClusterBridge/1 Application
LAN Application
CASROOT
CAS Linkage
Subcomponent
Components covered by this FS
Components NOT covered by this FS

FIG. 20

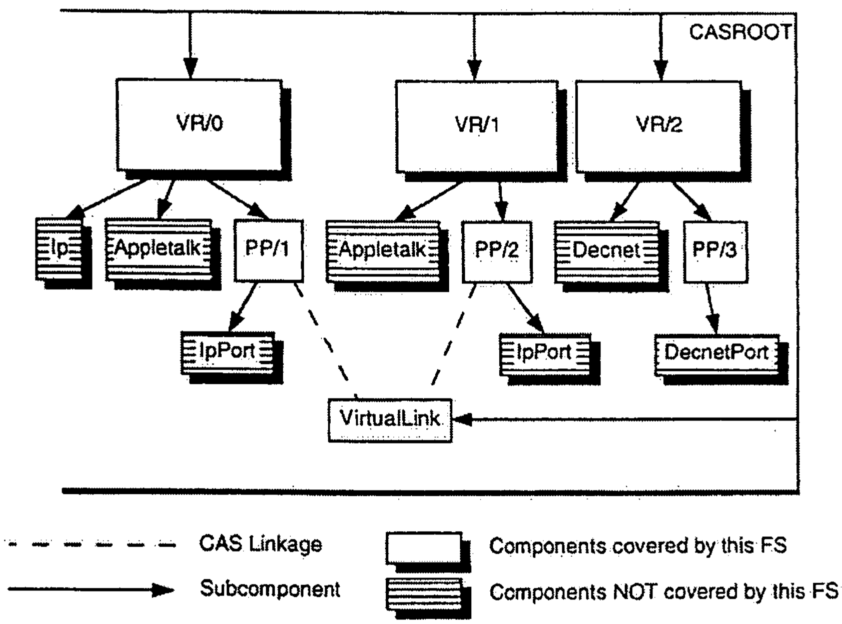

CASROOT
VR/0
VR/1
VR/2
Ip
Appletalk
PP/1
Appletalk
PP/2
Decnet
PP/3
IpPort
IpPort
DecnetPort
VirtualLink
CAS Linkage
Subcomponent
Components covered by this FS
Components NOT covered by this FS

FIG. 21

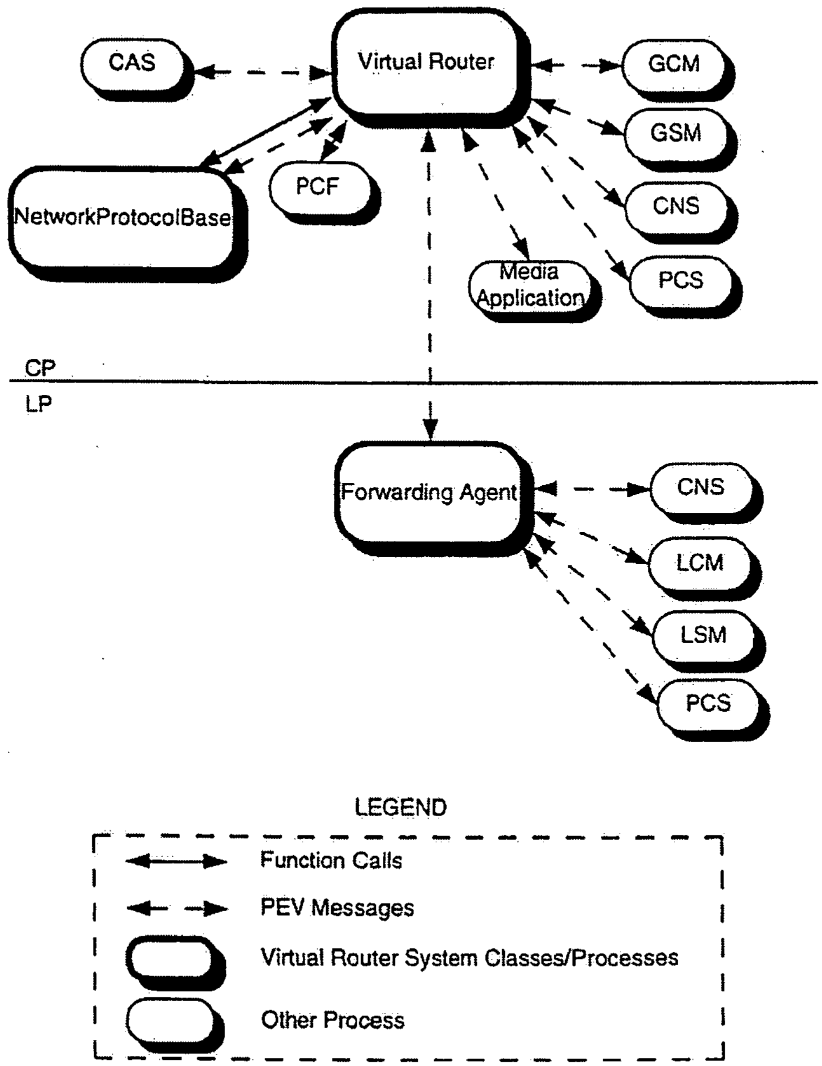

CAS
Virtual Router
GCM
GSM
CNS
PCS
PCF
NetworkProtocolBase
Media Application
CP
LP
Forwarding Agent
CNS
LCM
LSM
PCS
LEGEND
Function Calls
PEV Messages
Virtual Router System Classes/Processes
Other Process

FIG. 22

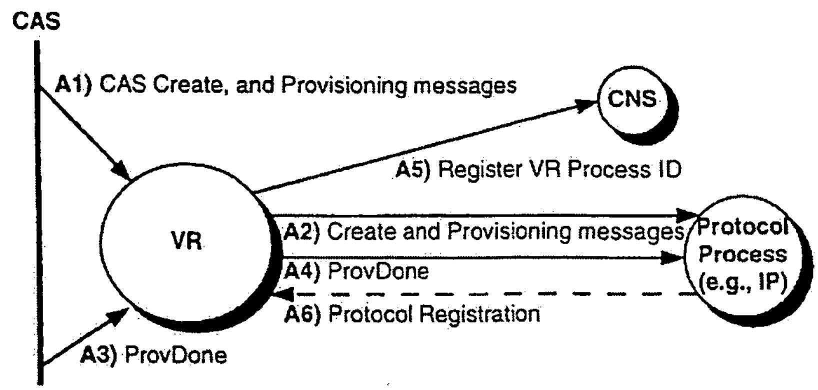

CAS
A1) CAS Create, and Provisioning messages
CNS
A5) Register VR Process ID
VR
A2) Create and Provisioning messages
Protocol Process (e.g., IP)
A4) ProvDone
A6) Protocol Registration
A3) ProvDone

FIG. 23

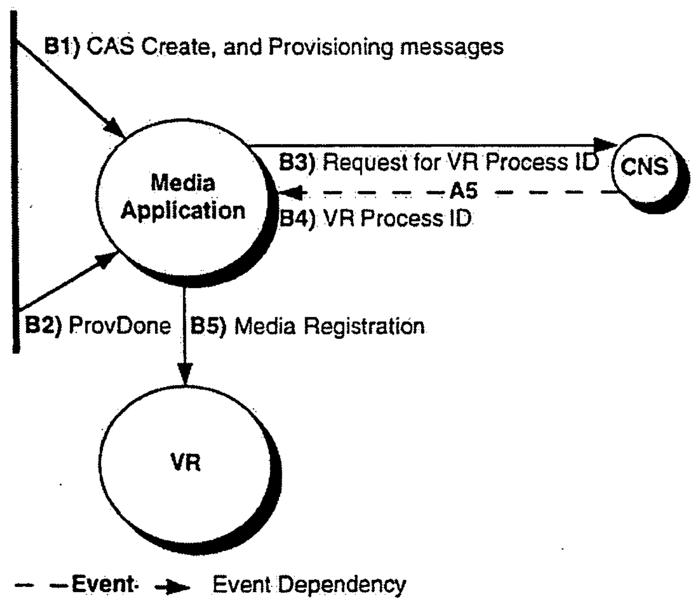

B1) CAS Create, and Provisioning messages
Media Application
B3) Request for VR Process ID
CNS
A5
B4) VR Process ID
B2) ProvDone
B5) Media Registration
VR
Event
Event Dependency

FIG. 24

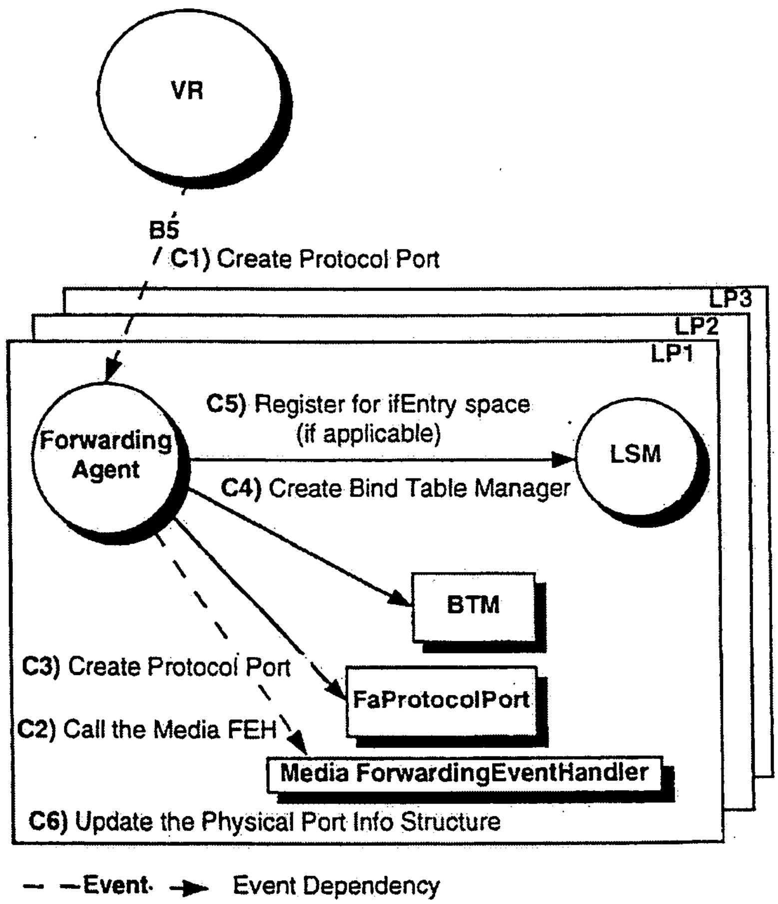

VR
B5
C1) Create Protocol Port
LP3
LP2
LP1
Forwarding Agent
C5) Register for ifEntry space (if applicable)
LSM
C4) Create Bind Table Manager
BTM
C3) Create Protocol Port
FaProtocolPort
C2) Call the Media FEH
Media ForwardingEventHandler
C6) Update the Physical Port Info Structure
Event
Event Dependency

FIG. 25

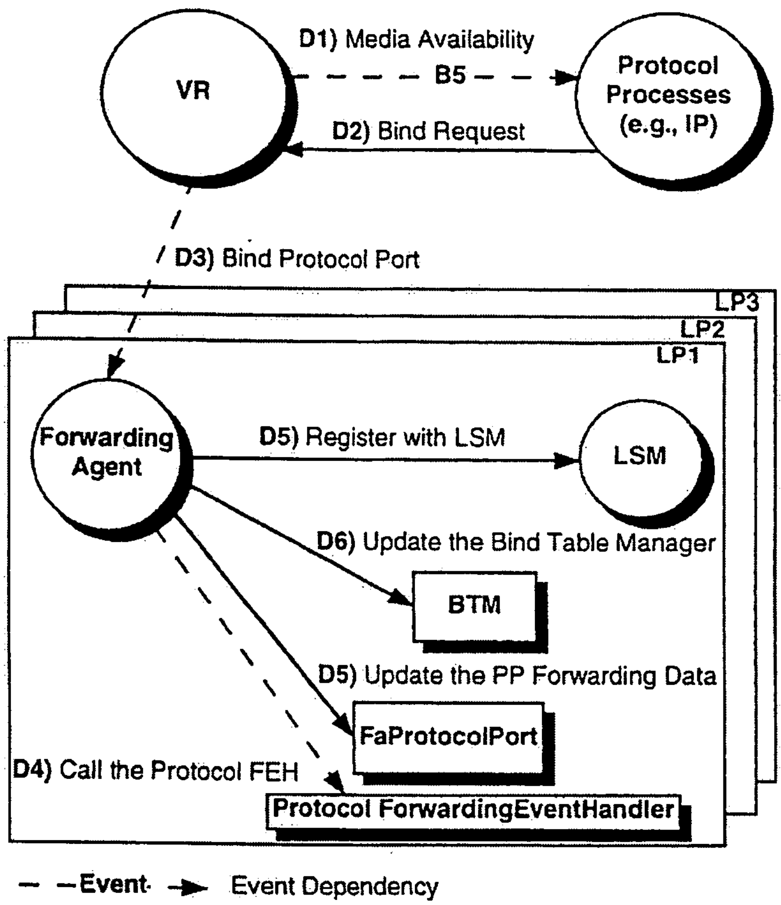

D1) Media Availability
B5
VR
Protocol Processes (e.g., IP)
D2) Bind Request
D3) Bind Protocol Port
LP3
LP2
LP1
Forwarding Agent
D5) Register with LSM
LSM
D6) Update the Bind Table Manager
BTM
D5) Update the PP Forwarding Data
FaProtocolPort
D4) Call the Protocol FEH
Protocol ForwardingEventHandler
Event
Event Dependency

FIG. 26

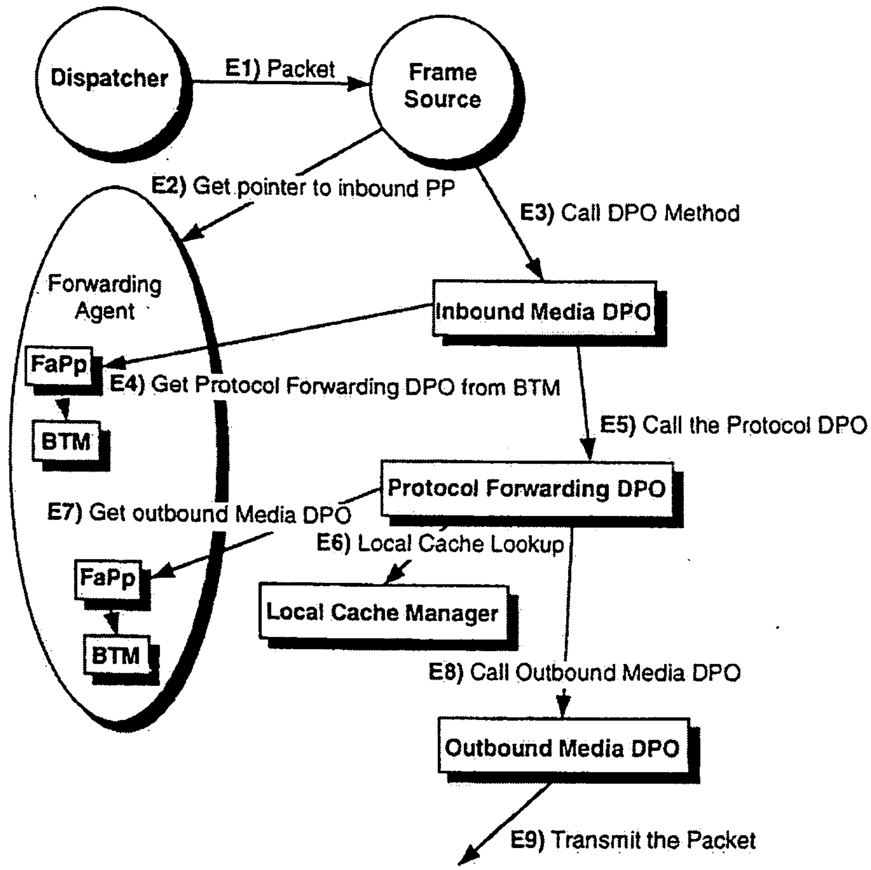

Dispatcher
E1) Packet
Frame Source
E2) Get pointer to inbound PP
E3) Call DPO Method
Forwarding Agent
Inbound Media DPO
FaPp
E4) Get Protocol Forwarding DPO from BTM
BTM
E5) Call the Protocol DPO
Protocol Forwarding DPO
E7) Get outbound Media DPO
E6) Local Cache Lookup
FaPp
Local Cache Manager
BTM
E8) Call Outbound Media DPO
Outbound Media DPO
E9) Transmit the Packet

FIG. 27

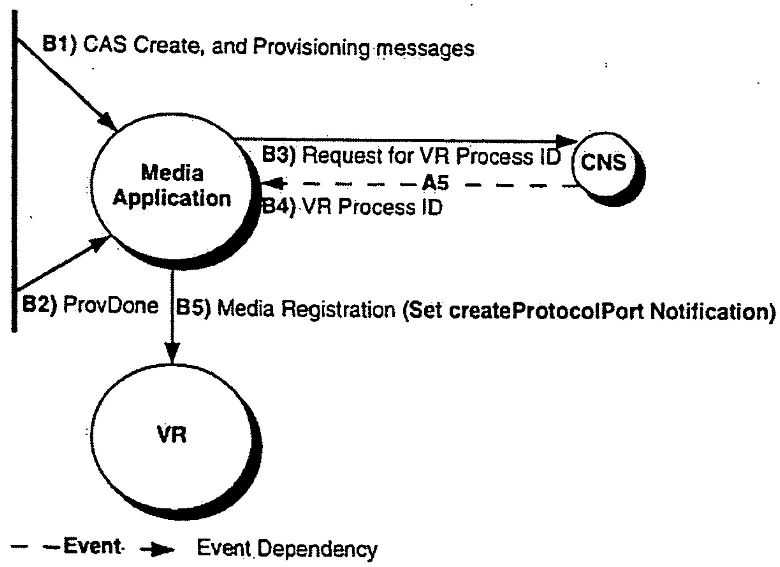

B1) CAS Create, and Provisioning messages
Media Application
B3) Request for VR Process ID
CNS
A5
B4) VR Process ID
B2) ProvDone
B5) Media Registration (Set createProtocolPort Notification)
VR
Event
Event Dependency

FIG. 28

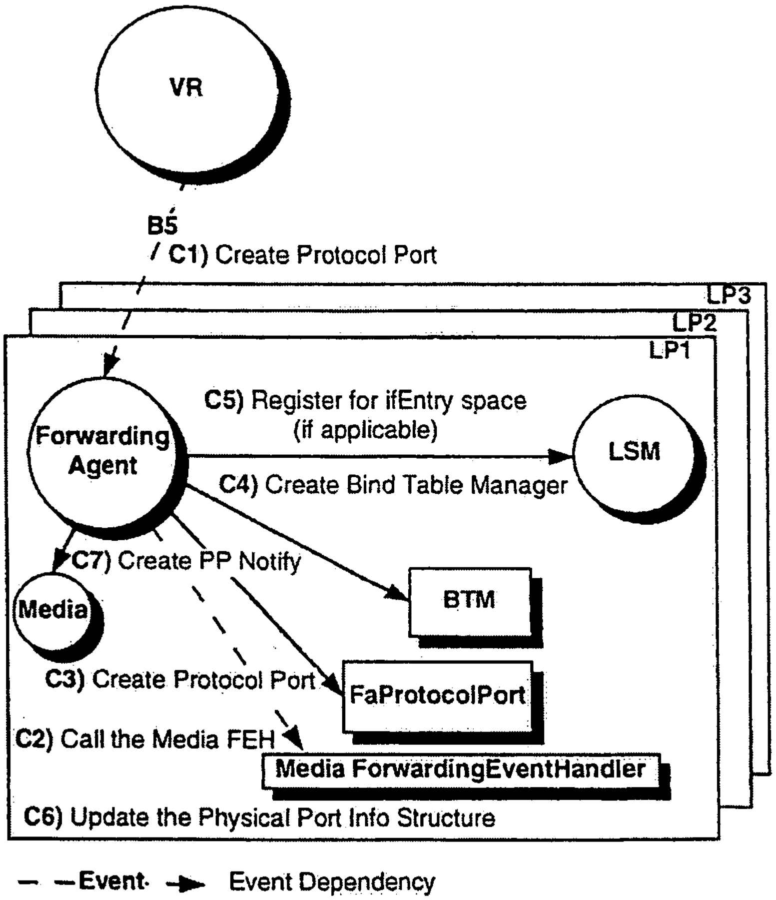

VR
B5
C1) Create Protocol Port
LP3
LP2
LP1
Forwarding Agent
C5) Register for ifEntry space (if applicable)
LSM
C4) Create Bind Table Manager
C7) Create PP Notify
Media
BTM
C3) Create Protocol Port
FaProtocolPort
C2) Call the Media FEH
Media ForwardingEventHandler
C6) Update the Physical Port Info Structure
Event
Event Dependency

FIG. 29

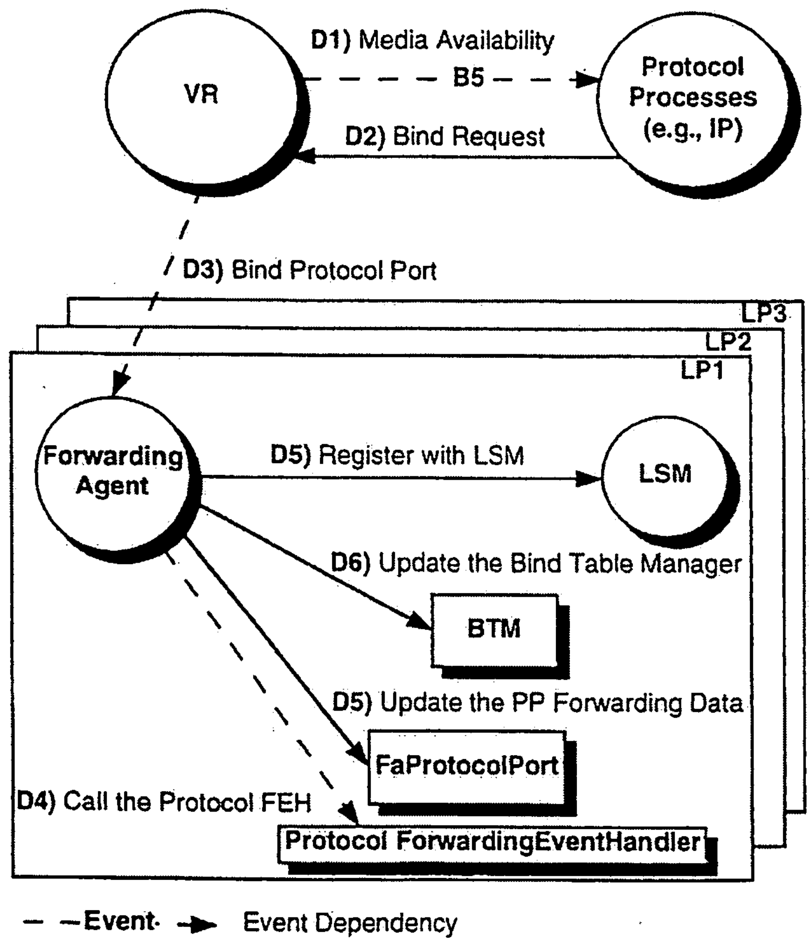

D1) Media Availability
VR
B5
Protocol Processes (e.g., IP)
D2) Bind Request
D3) Bind Protocol Port
LP3
LP2
LP1
Forwarding Agent
D5) Register with LSM
LSM
D6) Update the Bind Table Manager
BTM
D5) Update the PP Forwarding Data
FaProtocolPort
D4) Call the Protocol FEH
Protocol ForwardingEventHandler
Event
Event Dependency

FIG. 30

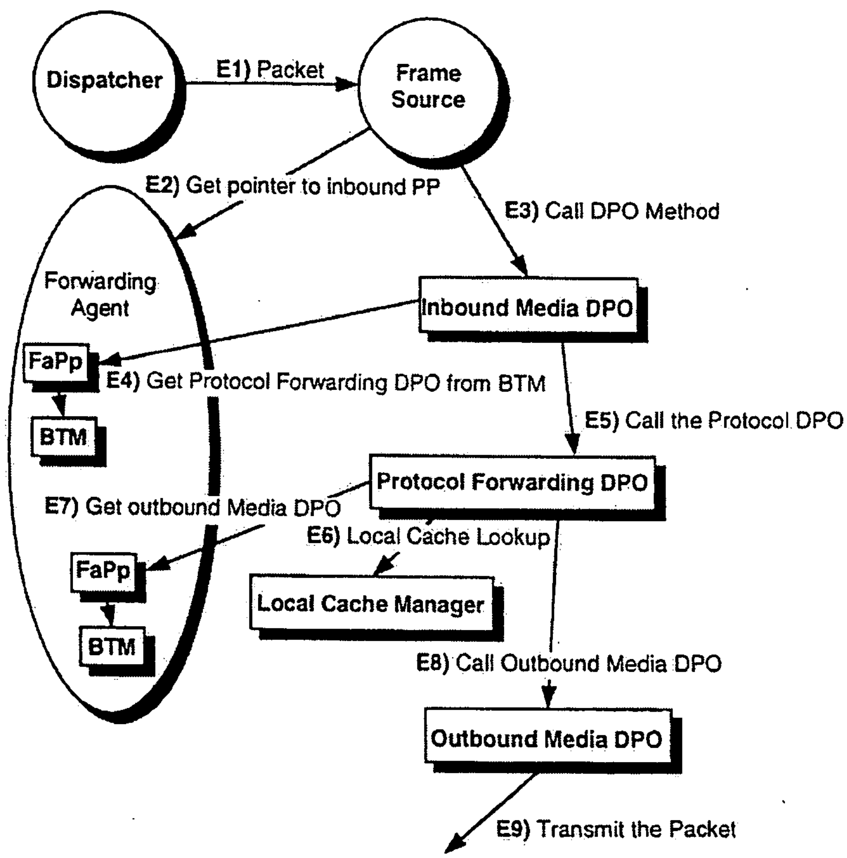

Dispatcher
E1) Packet
Frame Source
E2) Get pointer to inbound PP
E3) Call DPO Method
Forwarding Agent
Inbound Media DPO
FaPp
E4) Get Protocol Forwarding DPO from BTM
BTM
E5) Call the Protocol DPO
Protocol Forwarding DPO
E7) Get outbound Media DPO
E6) Local Cache Lookup
FaPp
Local Cache Manager
BTM
E8) Call Outbound Media DPO
Outbound Media DPO
E9) Transmit the Packet

FIG. 31

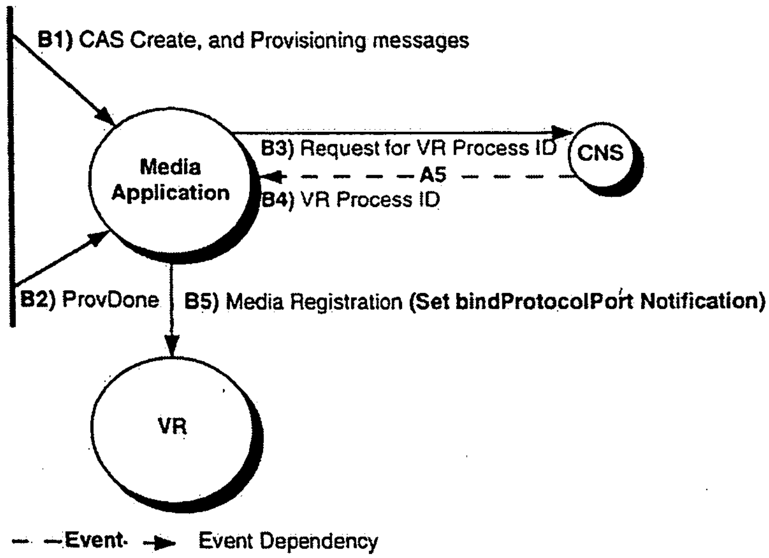

B1) CAS Create, and Provisioning messages
Media Application
B3) Request for VR Process ID
CNS
A5
B4) VR Process ID
B2) ProvDone
B5) Media Registration (Set bindProtocolPort Notification)
VR
Event
Event Dependency

FIG. 32

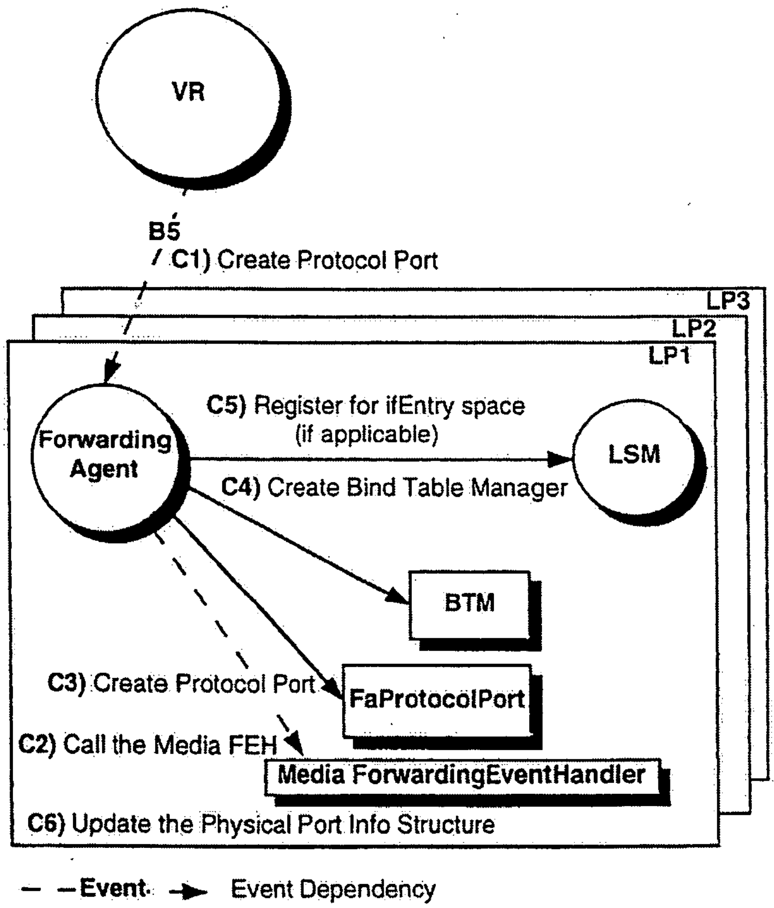

VR
B5
C1) Create Protocol Port
LP3
LP2
LP1
Forwarding Agent
C5) Register for ifEntry space
(if applicable)
LSM
C4) Create Bind Table Manager
BTM
C3) Create Protocol Port
FaProtocolPort
C2) Call the Media FEH
Media ForwardingEventHandler
C6) Update the Physical Port Info Structure
Event
Event Dependency

FIG. 33

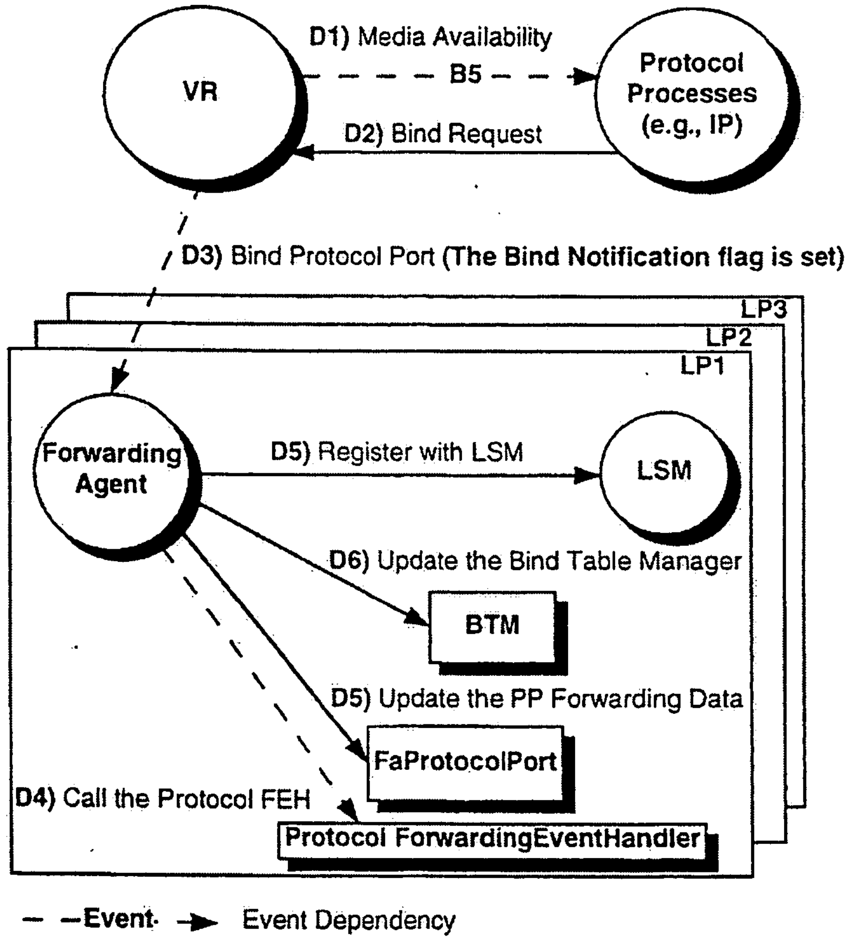

VR
D1) Media Availability
B5
Protocol Processes (e.g., IP)
D2) Bind Request
D3) Bind Protocol Port (The Bind Notification flag is set)
LP3
LP2
LP1
Forwarding Agent
D5) Register with LSM
LSM
D6) Update the Bind Table Manager
BTM
D5) Update the PP Forwarding Data
FaProtocolPort
D4) Call the Protocol FEH
Protocol ForwardingEventHandler
Event
Event Dependency

FIG. 34

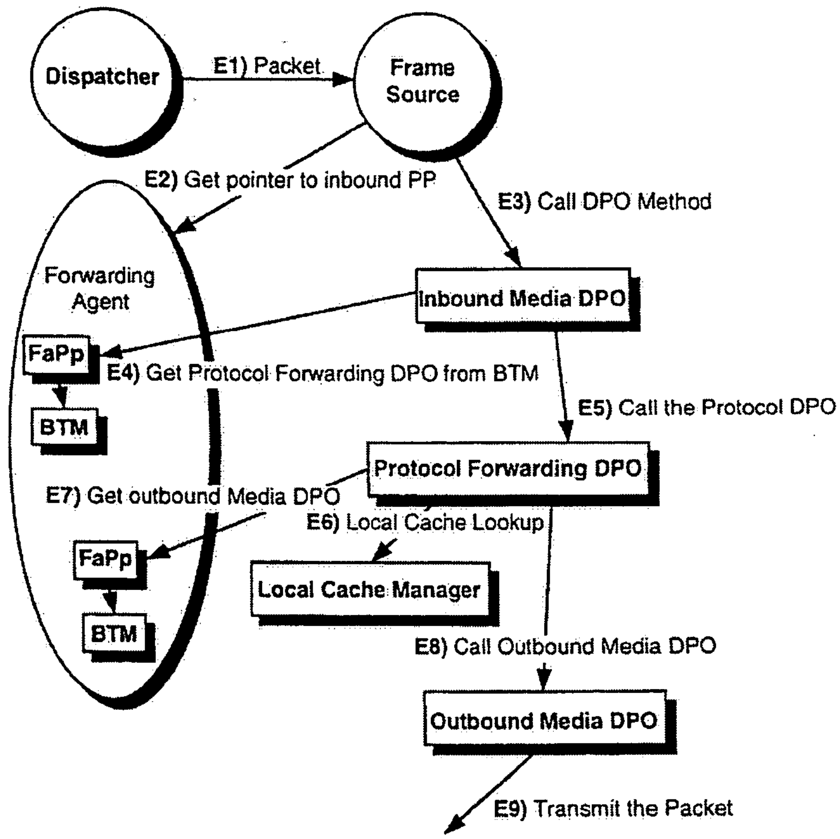

Dispatcher
E1) Packet
Frame Source
E2) Get pointer to inbound PP
E3) Call DPO Method
Forwarding Agent
Inbound Media DPO
FaPp
E4) Get Protocol Forwarding DPO from BTM
BTM
E5) Call the Protocol DPO
Protocol Forwarding DPO
E7) Get outbound Media DPO
E6) Local Cache Lookup
FaPp
Local Cache Manager
BTM
E8) Call Outbound Media DPO
Outbound Media DPO
E9) Transmit the Packet

FIG. 35

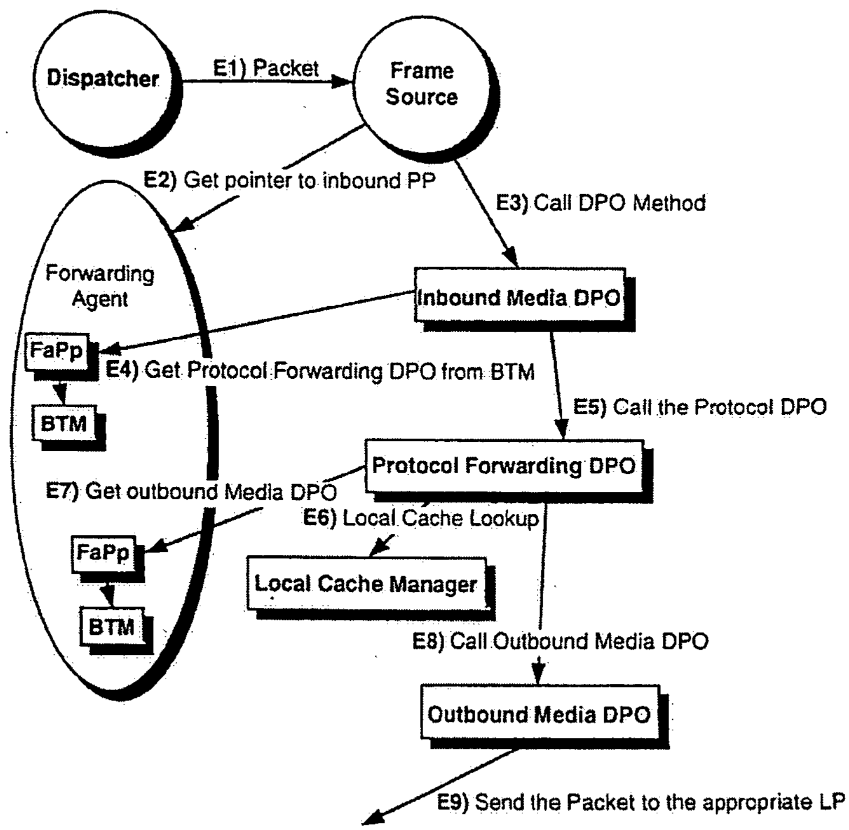

Dispatcher
E1) Packet
Frame Source
E2) Get pointer to inbound PP
E3) Call DPO Method
Forwarding Agent
Inbound Media DPO
FaPp
E4) Get Protocol Forwarding DPO from BTM
BTM
E5) Call the Protocol DPO
Protocol Forwarding DPO
E7) Get outbound Media DPO
E6) Local Cache Lookup
FaPp
Local Cache Manager
BTM
E8) Call Outbound Media DPO
Outbound Media DPO
E9) Send the Packet to the appropriate LP

FIG. 36

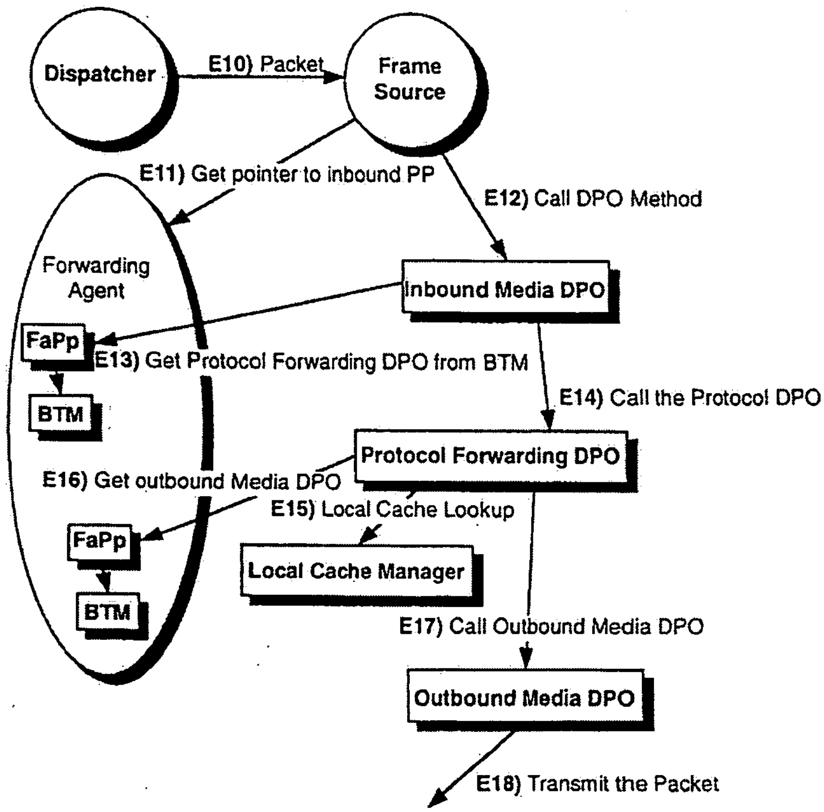

Dispatcher
E10) Packet
Frame Source
E11) Get pointer to inbound PP
E12) Call DPO Method
Forwarding Agent
Inbound Media DPO
FaPp
E13) Get Protocol Forwarding DPO from BTM
BTM
E14) Call the Protocol DPO
Protocol Forwarding DPO
E16) Get outbound Media DPO
E15) Local Cache Lookup
FaPp
Local Cache Manager
BTM
E17) Call Outbound Media DPO
Outbound Media DPO
E18) Transmit the Packet

FIG. 37

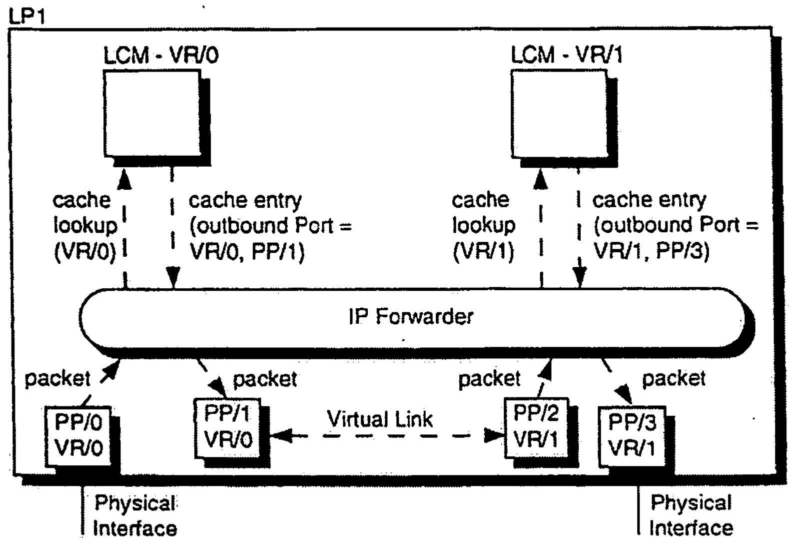

LP1
LCM - VR/0
LCM - VR/1
cache lookup (VR/0)
cache entry (outbound Port = VR/0, PP/1)
cache lookup (VR/1)
cache entry (outbound Port = VR/1, PP/3)
IP Forwarder
packet
packet
packet
packet
PP/0 VR/0
PP/1 VR/0
Virtual Link
PP/2 VR/1
PP/3 VR/1
Physical Interface
Physical Interface

FIG. 38

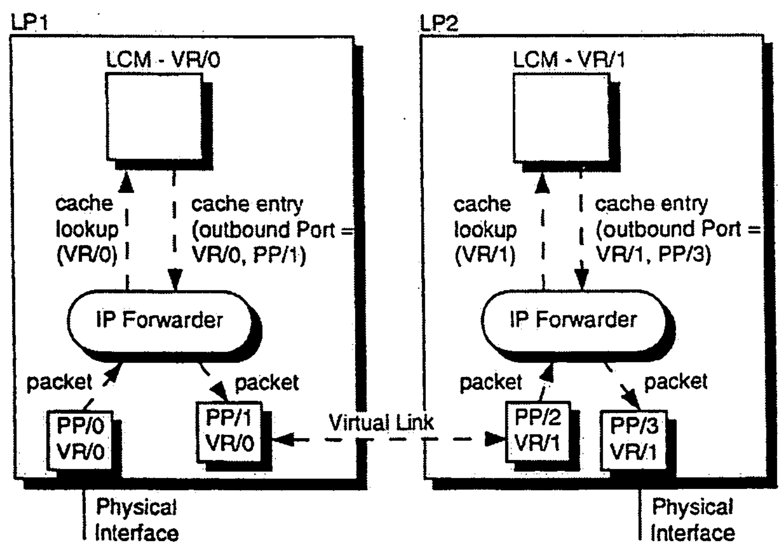

LP1
LP2
LCM - VR/0
LCM - VR/1
cache lookup (VR/0)
cache entry (outbound Port = VR/0, PP/1)
cache lookup (VR/1)
cache entry (outbound Port = VR/1, PP/3)
IP Forwarder
IP Forwarder
packet
packet
packet
packet
PP/0 VR/0
PP/1 VR/0
Virtual Link
PP/2 VR/1
PP/3 VR/1
Physical Interface
Physical Interface

FIG. 39

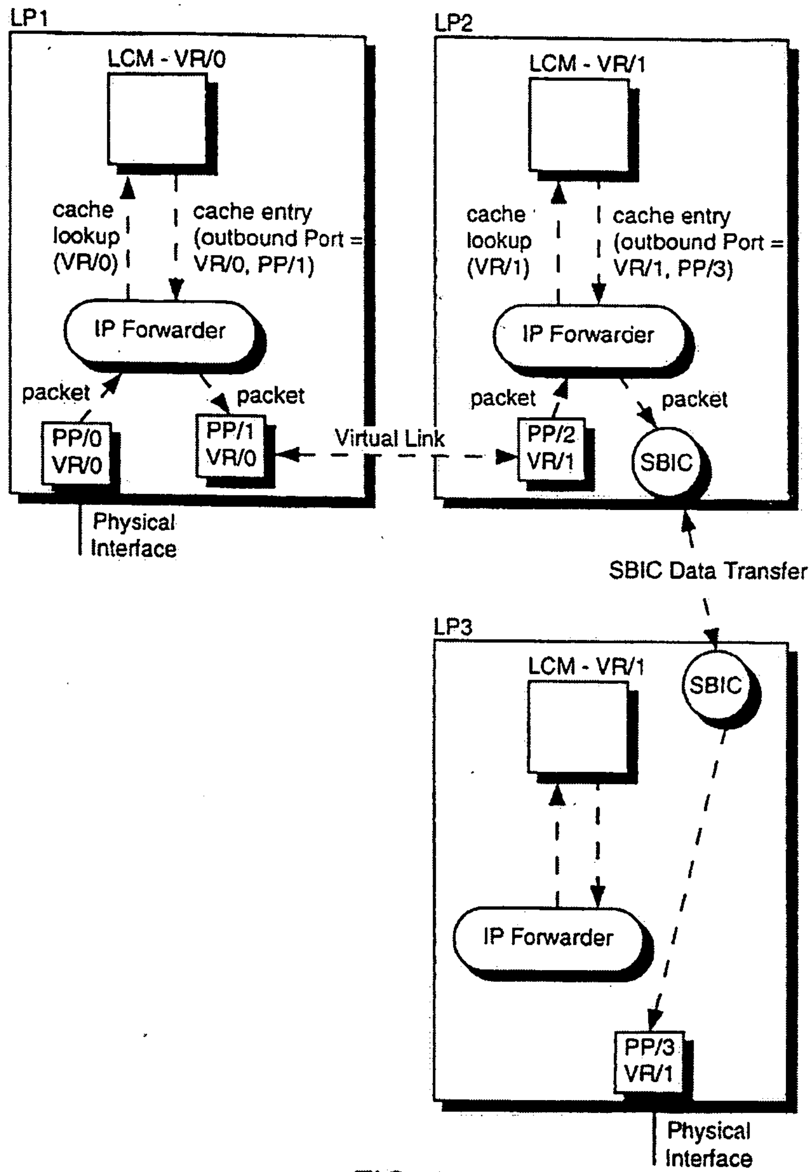

LP1
LCM - VR/0
cache lookup (VR/0)
cache entry (outbound Port = VR/0, PP/1)
IP Forwarder
packet
packet
PP/0 VR/0
PP/1 VR/0
Physical Interface
Virtual Link
LP2
LCM - VR/1
cache lookup (VR/1)
cache entry (outbound Port = VR/1, PP/3)
IP Forwarder
packet
packet
PP/2 VR/1
SBIC
SBIC Data Transfer
LP3
LCM - VR/1
SBIC
IP Forwarder
PP/3 VR/1
Physical Interface

FIG. 40

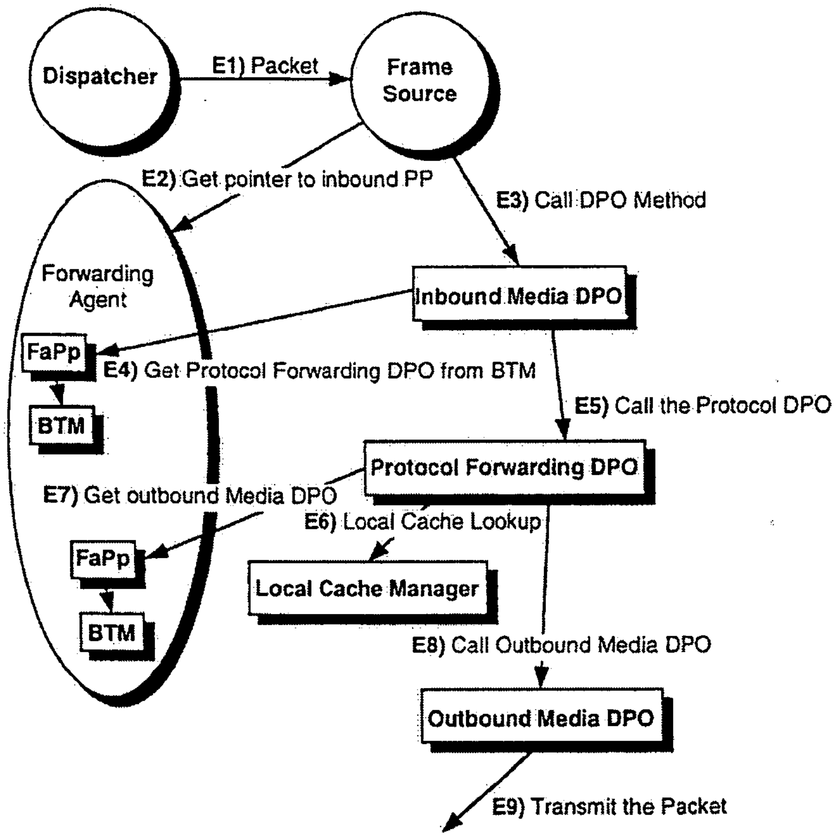

Dispatcher
E1) Packet
Frame Source
E2) Get pointer to inbound PP
E3) Call DPO Method
Forwarding Agent
Inbound Media DPO
FaPp
E4) Get Protocol Forwarding DPO from BTM
BTM
E5) Call the Protocol DPO
Protocol Forwarding DPO
E7) Get outbound Media DPO
E6) Local Cache Lookup
FaPp
Local Cache Manager
BTM
E8) Call Outbound Media DPO
Outbound Media DPO
E9) Transmit the Packet

FIG. 41

METHOD AND APPARATUS FOR VIRTUAL SWITCHING

RELATED INVENTIONS

The present invention is related to:

Co-pending U.S. patent application Ser. No. 08/366,221, filed on Dec. 29, 1994, which is entitled "Method And Apparatus For Accelerated Packet Forwarding" by Mark Bakke et al.,

Co-pending U.S. patent application Ser. No. 08/366,225, filed on Dec. 29, 1994, which is entitled "Method And Apparatus For Accelerated Packet Processing" by Geof Stone,

Co-pending U.S. patent application Ser. No. 08/366,222, filed on Dec. 29, 1994, which is entitled "Method And Apparatus For Radix Decision Packet Processing" by Geof Stone,

and which were all filed concurrently herewith and assigned to the assignee of the present invention.

FIELD OF THE INVENTION

The present invention relates generally to data communication networks. More particularly, the present invention relates to the operation of virtual switches within physical switching systems that direct the flow of protocol data units in the data communication networks.

BACKGROUND OF THE INVENTION

In a data communication network, a forwarding device (e.g., a data packet switch) directs protocol data units (e.g., data packets) from one network node to another. These data packets may include voice, video, or data information as well as any combination thereof.

To better understand how forwarding devices work within a data communication network, an analogy may be helpful. In many respects, data communication networks are similar to postal delivery systems, with pieces of mail, such as letters or packages, being comparable to the data packets which are transferred within a data communication network. In a postal delivery system, the pieces of mail may be input into the postal delivery system in a variety of ways. Once within the postal delivery system, all of the pieces of mail are collected and transported to nearby processing facilities where the pieces of mail are sorted for further processing. Although each piece of mail will have a unique delivery address, most of the pieces of mail are automatically sorted by a shorter zip code or some other type of routing code. Letters without zip codes must be sorted and processed by hand. Some postal delivery systems also have special forms of encoded delivery addresses, such as Post Office box numbers at a Post Office, which are not recognizable by other postal delivery systems such as Federal Express or United Parcel Service. Regardless of which particular postal delivery system the piece of mail is deposited into, once the mail has been sorted by destination it is routed through additional intermediary processing facilities until it arrives at the local indicated by the destination on the piece of mail. At this point, the zip code or routing code is no longer sufficient to deliver the piece of mail to the intended destination and the local delivery office must further decode the destination address in order to deliver the piece of mail to the intended recipient. In addition to processing pieces of mail for routing the mail to the correct destination, the pieces of mail may go on through several other processing steps. For

example, if the piece of mail is going out of the country, it must go through a customs operation in each country. If the national postal delivery system is being used to deliver the piece of mail then it must also be transferred from one national postal delivery system to another. In a private postal delivery system however, this transfer step would not be necessary. The pieces of mail may also be monitored or filtered for such things as mail fraud violation or shipment of hazardous materials.

Data packets are manipulated in a data communication network in a manner similar to that by which pieces of mail are delivered in a postal delivery system. Data packets, for example, are generated by many different types of means and are placed onto a communication network. Typically, the data packets are concentrated into a forwarding device, such as a local bridge or router, and are then directed by size and destination over one or more media types (e.g., fiber optic) which are connected to further forwarding devices that could be other larger or smaller bridges or routers. These destination devices then deliver the data packet to its terminal end point (i.e., the end user). Along the way the data communication network may perform filtering and monitoring functions with respect to the data packets.

Just like postal delivery systems have experienced ever increasing volumes of mail which must be delivered, the volume of protocol data units being transferred across computer networks continues to increase as experience is being gained with this new form of communication delivery system and as more and more applications, with more and more expansive communications requirements are being developed. In addition, quickly changing technology has made the underlying data transmission resources for computer communication networks relatively inexpensive. Fiber optics, for example, offer data transfer rates in the gigabyte per second range.

One of the existing types of forwarding devices which offer the greatest potential to meet the increasing demand on throughput rates are packet switches. Several classes of packet switches exist. Each class differs substantially from the other class of devices, but all may be commonly referred to as packet switches or forwarding devices.

A first class of packet switches is that commonly used in digital telephone exchanges. By analogy, these switches can perform the functions only of a dedicated mail truck which relays mail between post offices and drops mail pouches on a post office loading dock. These switches are intended only to transfer packets among the devices in a single station, such as a telephone exchange, and are not capable of performing any sorting operations. The format of the packet in these systems is chosen to make the hardware in the switch as simple as possible; and this usually means that the packets include fields designed for direct use by the hardware. The capabilities of this class of switches (for example, in such areas as congestion control) are very limited in order to keep the hardware simple.

A second class of packet switches is used in smaller or restricted computer networks, such as X.25 networks. By analogy, these switches are equivalent to a group of #10 envelope sorters in the Post Office. These sorters handle and process this size envelope efficiently within the post office by performing limited sorting and routing functions, but can not by themselves deliver mail to its destination. In some sense, these switches are very different from the first class of packet switches described above, because several of this second class of packet switches can work together like several #10 envelope sorters can work at one time in the Post

Office. However, there is one substantial similarity in that this second class of switches can only handle one format of packets (i.e., the protocols). The formats handled by the second class of packet switches is much more complex than those in the first class. This greater complexity is necessary because the protocols are designed to work in less restricted environments, and because the packet switches must provide a greater range of services. While the formats interpreted by the first class of switches are chosen for easy implementation in hardware, the data packets handled by this second class of switches are generally intended to be interpreted by software (which can easily and economically handle the greater complexity) and provides the inherit benefit of incremental flexibility in the design of the packet switch.

In a third class of packet switches, the packet protocols are intended to be used in very large data networks having many very dissimilar links (such as a mix of very high speed local area networks (LANs) and low speed long distance point to point lines). Examples of such protocols are the United States designed Transmission Control Protocol/Internet Protocol (TCP/IP), and the International Standards Organization's Connectionless Network Protocol (CLNP) protocols.

In addition, this third class of switches (commonly referred to as bridge/routers) often must handle multiple protocols simultaneously. This third class of switches is very similar to the mail processing devices used in the modern postal system. Just as there are many countries, there are many data packet protocols used in computer networks. While a single postal system was once thought to be sufficient to handle mail going anywhere in the world, today several competing systems like United Parcel Service, Federal Express, and the U.S. Postal Service exist to handle the special needs of mail going to every country, state, city, town, and street in the world. Similarly, in computer communication systems, the packet switches are more involved in the carrying of data, and must understand some of the details of each protocol to be able to correctly handle data packets which are being conveyed in that protocol. The routers in this third class of packet switches often have to make fairly complex changes to the data packets as they pass through the packet switch.

It is this latter class of packet switches to which the following detailed description primarily relates. It will be appreciated however, that the detailed description of this invention can readily be applied to the first and second class of switches as well.

In current conventional packet switch design, a programmed general purpose processor examines each data packet as it arrives over the network interface and then processes that packet. Packet processing requires assignment of the data packet to an outbound network interface for transmission over the next communications link in the data path.

Currently, most bridge/router implementations rely heavily on off-the-shelf microprocessors to perform the packet forwarding functions. The best implementations are able to sustain processing rates approaching 100,000 packets per second (PPS). When dealing with media such as Ethernet or current telecommunications lines, this processing rate is more than adequate. When faster media such as the Fiber Distributed Data Interface (FDDI) are used, existing processing rates may still be sufficient as long as there is only one such high packet rate interface present. When multiple high packet rate interfaces are used, 100,000 PPS become inadequate. Current software-based implementations for bridges/routers are simply not capable of media-rate packet forwarding on emerging media such as asynchronous transfer mode (ATM) or Optical Connection-12 Synchronous Optical Network (OC-12 SONET) which can accommodate communication rates up to 6 times the current 100 megabits per second limits to rates of 600 megabits per second. It should be noted that the ever increasing power of off-the-shelf microprocessors might solve the throughput problem, but this is probably a vain hope. For example, a single OC-24 ATM interface can sustain nearly 3 million internetworking protocol (IP) packets per second. This is over 30 times the rates achieved by the current best software techniques. If processing power doubles every year, the wait for sufficient processing power to make a software approach viable would be at least 4–5 years. In addition, the media capabilities will likely continue to increase over such a span of years. Additionally, any such processor will likely require large amounts of the fastest (most expensive) memory available to operate at full speed, resulting in an unacceptably high system cost.

Fortunately most individual packet switch customers will never require sustained packet transfer rates at these levels. However, the traditional approach of individual customers purchasing routers, bridges, modems, and leased phone lines is changing. A trend towards developing Metropolitan Area Networks (MANs) is beginning in the networking industry as an alternative to the traditional approach of individual customer local area networks (LANs) connected through customer owned leased telecommunication lines.

The more successful entrants in this area are capitalizing on three trends:

Fiber optic cable can be laid to most business and industrial premises by organizations possessing rights of way; this cable can be used to carry 100 Megabits/second or more of customer traffic, a bandwidth that appears almost limitless to customers.

The "demarkation point" is changing from a pair of copper wires to an Ethernet socket; the MAN vendor takes responsibility for the delivery of Ethernet packets between sites specified by the customer. The customer does not have to be concerned with the intricacies of bridges, routers, and modems, which permits market penetration into a far less sophisticated customer base.

Most potential customers are not interested in a public network connection. They simply want to interconnect a number of buildings or divisions which constitute the customer's enterprise in a metropolitan area.

These MAN vendors are dealing with "customers" in the truest sense of the word, where customer and MAN vendor are independent enterprises. The trends towards corporate decentralization are even producing analogous situations within large enterprises.

Second, enterprises are becoming far more distributed than before, and the very definition of an "enterprise" is changing. Where in the 1980's all individuals involved in a program could be expected to reside in one or two well defined locations, a more modern "enterprise" may consist of individuals from several divisions, several corporations, consultants, roving sales and marketing people, and workers who want to telecommute at their convenience. At the same time, this modern enterprise needs to protect their information from disclosure or sabotage from without the group while preserving a liberal access policy from within.

A wide area "backbone" is a tremendous investment on the part of any large enterprise. Yet at the same time, host computers and small scale networks are becoming easier to

administer while the expertise to administer them becomes more widespread. At the same time, organizations with a bias towards decentralization are seeing departments and divisions owning "their" hosts and "their" networks that they want to plug into a wide area backbone in order to carry their traffic. This traffic typically consists of communications to other divisions; however, increasingly it will also consist of traffic within a division with widely scattered sites.

All of this follows a known trend of increasing decentralization in the workplace. Many years ago, Management Information System (MIS) computers and all the networks in the enterprise. Access policy (such as was needed then) could largely be done through system administration of the host computers.

The advent of personal computers and affordable workstations meant that the networking administrators no longer owned all of the host computers anymore, yet these same MIS organizations are still charged with their traditional role of ensuring the integrity of the enterprise's data. This has led to the rise of routing and filtering functions within routers, making access control, a network, rather than a host problem.

Now the networking industry is moving up one more level. Today, clients not only own their own hosts, they own their own networks and want to connect these networks on a network to network basis. Yet at the same time, the need to preserve the integrity of data moving among client networks still exists. This trend is producing not just a "network", but a "network of networks", where the purpose of a backbone is to serve the needs and foibles of its constituent networks, not all of which may belong to the same enterprise.

The concept of a "network of networks" is not new. In fact, this was one of the guiding philosophies which led to the original creation of the Internet. Unfortunately, the logic to support this has only been applied to Internet Protocol and more recently to the Open Systems Interconnection (OSI) model. IP has been designed to perform this trick once (at the Internet level) and is little help in organizing traffic within a single IP network. Furthermore, IP cannot cope with the notion that a single network may be scattered at different points throughout the Internet.

Thus, a need exists for a way to provide equivalent protocols and management tools to those that exist today within a single network that will work in a "network of networks" paradigm.

One part of a solution to this problem is the use of Closed User Groups. A Closed User Group is a potentially widely distributed community of users and their associated networked computer equipment who permit free and open communications within the community, but severely restrict communication to points outside the community. The use of these Closed User Groups by MAN vendors is a means of addressing the trend that network topological or geographic proximity is becoming independent of access proximity. The general concept of a Closed User Group network environment is where data packets from different enterprises never interact with each other; however all of the data packets are carried across at least part of the network on the same shared media such an OC-12 data communications link. In a MAN environment that supports closed user groups, LAN's containing host computers are identified as belonging to a specific Closed User Group, and data packets for this LAN are transported to the desired location, then validated on receipt.

To better understand this concept let's refer once again to the postal service analogy. Several postal services need to send packages to the East coast of the United States on a regular basis. At first Federal Express, United Parcel Service, and the United States Postal Services all send these packages by separate airplanes, but a bright entrepreneur offers to build a special cargo plane that will carry all three sets of packages to the East coast in a single trip. All of the services like the idea, because it saves them operating expenses, but they want assurances that the none of the packages will get mixed with packages from other postal services. The entrepreneur agrees to divide the plane into three separate cargo areas so that no mixture of packages is possible. As a result, everyone is happy and the entrepreneur now has a thriving business. The MAN vendors are very similar to this entrepreneur and the postal services can be likened to individual companies or enterprises within the MAN's coverage area. Each MAN vendor provides these separate cargo areas by assigning each enterprise to a different Closed User Group. Thus, even though data from several enterprises are traveling on the same MAN shared medium data path, the data is separated by the Closed User Group assignments.

Although the user of Closed User Groups by MAN vendors offers a partial solution to the problems of "network of networks", there are no existing solutions for managing Closed User Groups that provide protocols and management tools equivalent to those now in use within a single network. A need still exists for an improved protocol data unit (i.e., frame, cell, or packet) forwarding system which solves the above-identified problems and promotes the use of the Closed User Group paradigm, while providing a wide variety of access control tools that permit network managers to assign users to a group or groups, and then define the policy of how those groups can interact within themselves and with each other.

SUMMARY OF THE INVENTION

The present invention provides a packet processing system which contains virtual switches within physical switching systems that direct the flow of protocol data units in a data communication network. The present invention addresses the problem of providing Closed User Groups on shared medium data paths by providing protocols, algorithms, and bridge/router architectural designs that are capable of processing packets at multi-gigabyte rates while maintaining appropriate access policies and/or network security measures. By using all of these principles, the present invention reduces the cost of providing these packet switching services by enabling a single physical data switch to be divided into two or more virtual switches which individually process packets from different Closed User Groups. With reference to the postal delivery analogy, the present invention provides the details on how terminals at each airport can be designed, built, and operated to maintain separate package cargo areas for each postal service (i.e., separate virtual switches for each Closed User Group) to insure that packages from different postal services are not mixed up either before or after they are loaded onto the single airplane.

In accordance with a first aspect of the invention, a physical switching device for use in a communication network to switch OSI network layer protocol data traits within the communication network is provided. The physical switching device includes at least a first and a second virtual switch. Each virtual switch includes a decision mechanism for determining an associated directive based on a destination identifier within a particular protocol data unit received

at a data port. A processor is operatively coupled to each virtual switch to insert the particular protocol data unit into an outgoing data stream on another data port according to the associated directive to enable delivery of the protocol data unit to the destination identifier. These data ports are associated with a set of data interfaces selected from a plurality of data interfaces in a physical communication network switch. The set of data interfaces is assigned exclusively to a unique virtual switching device. These data ports can take many forms, including but not limited to, a data interface on the physical switch, a time slot out of several time slots in a time-divided frame received at a data interface on the physical switch, and a code divided cell out of several code divided cells received at one or more data interface on the physical switch.

The physical switching device preferably is designed to accommodate data interfaces of differing types such that the set of data interfaces assigned to a virtual switch may include a first data interface which manipulates a protocol data unit having a different protocol type from a second data interface such that protocol data units of different protocol types can be switched within a single virtual switch. The different protocol data unit protocol types may differ by having differing OSI physical layer media types, differing OSI link layer signaling protocols, and/or differing OSI network layer protocols.

A management apparatus is operatively coupled to each virtual switch to maintain information on an association between the plurality of data interfaces and the virtual switches. The management apparatus includes a controller dependent on the association information for limiting the processor of each virtual switch to only inserting the particular protocol data unit into an outgoing data stream on another data port associated with the same virtual switch which received the particular protocol data unit.

Further, it is desirable for the management apparatus to have a reassigning mechanism for changing a set assignment of a particular data interface such that the particular data port assignment can be moved between the virtual switching devices as needed (i.e., the data port can be moved).

Furthermore, it is necessary for the management apparatus to maintain a database of known destination identifiers and to require verification that the destination identifier in the particular protocol data unit is in the database prior to inserting the particular protocol data unit into an outgoing data stream on another data port such that delivery of the protocol data unit to an unknown destination identifier is prevented.

Each virtual switch processor preferably performs restructuring and/or monitoring operations on the particular protocol data unit. The restructuring operations include deleting, inserting, and/or replacing bits in the particular protocol data unit in accordance with the associated directive prior to inserting the particular protocol data unit into the outgoing data stream. The monitoring operations include dropping, sending, sending a copy of, and/or auditing the contents of the particular protocol data unit in accordance with the associated directive prior to inserting the particular protocol data unit into the outgoing data stream.

In accordance with a second aspect of the invention, a physical switching device for use in a communication network to switch protocol data units within the communication network on a shared communication medium is provided. The physical switching device includes at least a first and a second virtual switch which is similar to that which was described in the first aspect of the present invention; however, the management apparatus is different. This different management apparatus is a virtual link management apparatus which is operatively coupled to the virtual switches. The virtual link management apparatus maintains information on at least one virtual link between at least the first and the second virtual switches. The virtual link has a first end and a second end of a data path on the shared communication medium. Each end consists of a data port from the plurality of data interfaces in the physical communication network switch.

The first and the second virtual link end of the at least one virtual link preferably are in a different set of data ports assigned exclusively to the first and the second virtual switch, respectively, such that the virtual link provides a data path between the first and the second virtual switches on the shared communication medium. The first and the second virtual switches preferably are located in a single geographic location (i.e., within the same network hardware device rack) and the shared communication medium preferably is a memory shared between the first and the second virtual switches.

Alternatively, the first and the second virtual switches may be geographically remote from one another. In addition, the first and the second virtual link ends may be in a single set of data interfaces assigned exclusively to the first and the second virtual switches such that the virtual link provides a data path between the first and the second virtual switches on the shared communication medium across a geographic distance. In this alternative arrangement, the shared communication medium preferably consists of a high data transfer rate link between the first and the second virtual switches which spans the geographic distance.

In addition, a filter may be operatively coupled to the data path which filters protocol data units communicated in either virtual link data path according to an access policy that is separately specified in each virtual switch.

In accordance with a third aspect of the invention, a communication system which delivers OSI network layer protocol data units within a first and a second virtual closed user group on a shared communication medium is provided. The communication system includes a first virtual closed user group processor for examining and modifying data bits within a protocol data unit received from a member of the first virtual closed user group on the shared communication medium. Each member of the first virtual closed user group has a unique destination identifier. The first virtual closed user group processor includes a delivery mechanism for delivering the modified protocol data unit to another member of the first virtual closed user group.

The communication system also includes a second virtual closed user group processor which is similar to the first virtual closed user group processor. The second virtual closed user group processor examines and modifies data bits within a protocol data unit received from a member of the second virtual closed user group on the shared communication medium. Also, each member of the second virtual closed user group has a unique destination identifier. In addition, the second virtual closed user group processor includes a delivery mechanism for delivering the modified protocol data unit to another member of the second virtual closed user group.

A framer is operatively coupled to the first and the second virtual closed user group processors to maintain a database of all destination identifiers currently reachable for delivery of protocol data units within the communication system. This framer preferably requires verification that each desti-

nation identifier in a protocol data unit on the shared communication medium can be currently reached for delivery through a lookup in the database, prior to completing delivery of the protocol data unit to the associated destination identifier. The framer preferably further limits access to the database such that each virtual closed user group only has access to specific destination identifiers owned by that particular virtual closed user group so that a protocol data unit having a destination identifier which is not owned by the particular virtual closed user group will not be delivered.

Each virtual closed user group processor modifies and/or monitors protocol data units. The processor modifies data bits within a received protocol data unit by deleting, inserting, and replacing bits in the received protocol data unit prior to delivering the modified protocol data unit to another member of the same virtual closed user group. The processor monitors the received protocol data unit by dropping, sending, sending a copy of, and auditing the contents of the received protocol data unit prior to delivering the modified protocol data unit to another member of the same virtual closed user group.

In addition, each virtual closed user group processor preferably delivers the modified protocol data unit to another member of the same virtual closed user group without modifying the predetermined OSI physical layer, link layer, and network layer access protocols used to communicate protocol data units over the shared communication medium. This provides seamless integration of this closed user group functionality to LAN managers even though the LANs may be operating within a MAN as separate closed user groups. This lack of modification of the access protocols also has the advantage of enabling each virtual closed user group processor to allow any particular device capable of communicating on the shared communication medium (e.g., port with a destination identifier) to be a member of either virtual closed user group by having the framer means limit database access to destination identifiers associated with the particular device to a particular desired virtual closed user group.

The framer preferably also includes a mechanism for assigning incoming protocol data unit traffic to each virtual closed user group based on an access policy that is separately specified in each virtual closed user group.

In the preferred embodiment communication system operations of the first and the second virtual closed user group processor are performed by a first and a second virtual switch, respectively. Each virtual switch includes a decision mechanism for determining an associated directive based on a destination identifier within a particular protocol data unit received at a data port. In addition, each virtual switch includes a processor which performs the functions of the virtual closed user group delivery mechanism by inserting the particular protocol data unit into an outgoing data stream on another data port according to the associated directive to enable delivery of the protocol data unit to the destination identifier within the protocol data unit.

In an alternative embodiment to this third aspect of the present invention, the operations of the first virtual closed user group processor are divided between a first and a second virtual switch. This spreads the processing load between two virtual switches and takes into account typical communication system configurations which have many geographically separate physical switches devoted to the same closed user group.

In either embodiment, the first and the second virtual switches may be located within a single physical switching device. Both data ports for each virtual switch are then from a set of data interfaces in the physical switching device assigned exclusively to the same virtual switch.

Also in either embodiment, the first and the second virtual switches may be located within different physical switching devices. Both data ports for each virtual switch are then from a set of data interfaces in the respective physical switching devices which are assigned exclusively to the same virtual switch. As noted above, the different physical switching devices may geographically remote from one another.

Each data port may be either a data interface on a physical switching device, a time slot out of several time slots in a time-divided frame received at a data interface on a physical switching device, or a code divided cells out of several code divided cells received at at least one data interface on a physical switching device.

The physical switching device preferably is designed to accommodate data interfaces capable of manipulating different protocol types such that each set of data interfaces assigned to a virtual switch may include two or more data interfaces having mechanisms for manipulating protocol data units having different protocol types and the virtual switch is configured to switch protocol data unit coming from these data interfaces with different mechanisms. The differences in the protocol data unit data protocol types may include differing OSI physical layer media types, differing OSI link layer signaling protocols, and/or differing OSI network layer protocols.

Each virtual switch processor modifies and/or monitors protocol data units. The processor modifies data bits within a received protocol data unit by deleting, inserting, and replacing bits in the received protocol data unit prior to delivering the modified protocol data unit to another member of the same virtual closed user group. The processor monitors the received protocol data unit by dropping, sending, sending a copy of, and auditing the contents of the received protocol data unit prior to delivering the modified protocol data unit to another member of the same virtual closed user group.

In addition, the communication system may include a virtual link between the first and the second virtual switches. This virtual link consists of a first end and a second end of a data path on the shared communication medium, where each end is a data port in a different virtual closed user group. To enforce access policies a filter may be operatively coupled to the data path to filter protocol data units communicated in the data path.

This third aspect of the invention also can be implemented in a device-implemented method to deliver protocol data units within a first and a second virtual closed user group on a shared communication medium in a communication system. This delivery method includes examining and modifying data bits within a protocol data unit received from a member of the first virtual closed user group on the shared communication medium wherein each member of the first virtual closed user group has a unique destination identifier. In addition, data bits within a protocol data unit received from a member of the second virtual closed user group on the shared communication medium are examined and modified. Each member of the second virtual closed user group also has a unique destination identifier. Further, a database of all destination identifiers currently reachable for delivery of protocol data units within the communication system is maintained. Access to this database is limited such that each virtual closed user group only has access to specific destination identifiers owned by that particular virtual closed user group. Also, verification that each destination identifier in a

protocol data unit on the shared communication medium is currently reachable for delivery through a lookup in the database is required prior to completing delivery of the protocol data unit to the associated destination identifier. Subsequently, the first virtual closed user group modified protocol data unit is delivered to another member of the first virtual closed user group after verifying that the first virtual closed user group member destination identifier is currently reachable. In addition, the second virtual closed user group modified protocol data unit is delivered to another member of the second virtual closed user group after verifying that the second virtual closed user group member destination identifier is currently reachable. This results in protocol data units having destination identifiers which are not owned by the particular virtual closed user group not being delivered anywhere.

Each examining and modifying process preferably includes modifying data bits within a received protocol data unit by deleting, inserting, and replacing bits in the received protocol data unit prior to delivering the modified protocol data unit to another member of the same virtual closed user group. Alternatively, each examining and modifying process may include monitoring the received protocol data unit by dropping, sending, sending a copy of, and auditing the contents of the received protocol data unit prior to delivering the modified protocol data unit to another member of the same virtual closed user group.

These device-implemented steps preferably are performed such that all predetermined physical layer, link layer, and network layer access protocols used to communicate protocol data units over the shared communication medium are preserved. In other words, no changes to protocol like IP, ATM, OC-12 or the like are necessary to implement the present invention, because these steps are seamlessly integrated with this access protocols. This seamless integration enables the addition benefit that any particular device capable of communicating on the shared communication medium can be a member of either virtual closed user group by performing an additional step of adding a destination identifier associated with the particular device to the database.

These device-implemented steps preferably also include a step of assigning incoming protocol data unit traffic to each virtual closed user group based on an access policy that is separately specified in each virtual closed user group.

In addition, the device-implemented steps may include a step of providing a virtual link between the first and the second virtual closed user group. The virtual link includes a first end and a second end of a data path on the shared communication medium. Also, each virtual link end includes a data port in a different virtual closed user group. A shared memory can be used as the shared communication medium to provide the virtual link. Alternatively, a high data transfer rate link which spans a geographic distance between the first and the second virtual closed user group can be utilized to provide the virtual link. A filtering process can be performed on the virtual link such that protocol data units communicated in the virtual link data path are filtered according to an access policy.

These and various other features as well as advantages which characterize the present invention will be apparent upon reading of the following detailed description and review of the associated drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a preferred embodiment packet processing system in accordance with the present invention.

FIG. 2 is a block diagram of a preferred embodiment physical switching device having virtual switches in accordance with the present invention.

FIG. 3 is a block diagram of an alternative preferred embodiment physical switching device which has a virtual link in accordance with the present invention.

FIG. 4 is a block diagram of another alternative preferred embodiment having virtual closed user groups in accordance with the present invention.

FIG. 5 is a block diagram providing more detail for the decision mechanism/preprocessor shown in FIG. 2 in accordance with the present invention.

FIG. 6 is a flowchart of the preferred embodiment operations of the use of virtual closed user groups as shown in FIG. 4 in accordance with the present invention.

FIG. 7 is a block diagram showing a configuration of Remote Groups in accordance with the present invention.

FIG. 8 is a block diagram showing a virtual link in accordance with the present invention.

FIGS. 9 and 10 are block diagrams showing an example of a purely segregated metropolitan network from a geographic and connectivity point of view, respectively, in accordance with the present invention.

FIGS. 11 and 12 are block diagrams showing an example of a purely segregated metropolitan network having Internet from a physical connectivity, and customer's management view, respectively, in accordance with the present invention view, respectively, in accordance with the present invention.

FIG. 13 is block diagram showing an extension of the example shown in FIGS. 11 and 12 of a purely segregated metropolitan network having Internet which also wants to provide Internetworking Service in accordance with the present invention.

FIGS. 14, 15, 16, and 17 are block diagrams showing multiple virtual networks within an enterprise from a physical, network topology, virtual routing, and consolidated router point of view, respectively, in accordance with the present invention.

FIG. 18 is a block diagram showing an example of a component hierarchy including three Virtual Routers (VRs) and multiple protocol stacks and protocol ports in accordance with the present invention.

FIG. 19 is a block diagram which shows the entire component hierarchy under the VR in accordance with the present invention.

FIG. 20 is a block diagram which shows an example of multiple cluster bridges, each associated with one bridge protocol port in accordance with the present invention.

FIG. 21 is a block diagram which shows an example of inter-VR component hierarchy which supports virtual links in accordance with the present invention.

FIG. 22 is a block diagram which shows a system overview of the VirtualRouterProcess, ForwardingAgentProcess, and the NetworkProtocolBaseProcess in accordance with the present invention.

FIG. 23 is a block diagram which shows the per port initialization required prior to packet forwarding, including Virtual Router Creation and Provisioning, in accordance with the present invention.

FIG. 24 is a block diagram which shows the per port initialization required prior to packet forwarding, including LAN Media Application Creation and Initialization, in accordance with the present invention.

FIG. 25 is a block diagram which shows the Forwarding Data Distribution—LAN Media which occurs after the LAN Media Application Creation and Initialization steps shown in FIG. 24, in accordance with the present invention.

FIG. 26 is a block diagram which shows the Protocol Binding—LAN Media which occurs after the LAN Media Application Creation and Initialization steps shown in FIG. 24, in accordance with the present invention.

FIG. 27 is a block diagram which shows the Packet Forwarding—LAN Media in accordance with the present invention.

FIG. 28 is a block diagram which shows the per port initialization required prior to packet forwarding, including Media Application Creation and Initialization—Multi-point WAN, in accordance with the present invention.

FIG. 29 is a block diagram which shows the Forwarding Data Distribution—Multi-point WAN which occurs after the Media Application Creation and Initialization steps shown in FIG. 28, in accordance with the present invention.

FIG. 30 is a block diagram which shows the Protocol Binding—Multi-point WAN which occurs after the Media Application Creation and Initialization steps shown in FIG. 28, in accordance with the present invention.

FIG. 31 is a block diagram which shows the Packet Forwarding—Multi-point WAN in accordance with the present invention.

FIG. 32 is a block diagram which shows the per port initialization required prior to packet forwarding, including Media Application Creation and Initialization—Point to Point Protocol (PPP) WAN, in accordance with the present invention.

FIG. 33 is a block diagram which shows the Forwarding Data Distribution—PPP WAN which occurs after the Media Application Creation and Initialization steps shown in FIG. 32, in accordance with the present invention.

FIG. 34 is a block diagram which shows the Protocol Binding—PPP WAN which occurs after the Media Application Creation and Initialization steps shown in FIG. 28, in accordance with the present invention.

FIG. 35 is a block diagram which shows the Packet Forwarding—PPP WAN in accordance with the present invention.

FIGS. 36 and 37 are block diagrams which show the Packet Forwarding for Virtual Link Media in accordance with the present invention.

FIG. 38 is a block diagram which shows an example where the outbound physical port is on the same logical port (LP) as the inbound physical port in accordance with the present invention.

FIGS. 39 and 40 are block diagrams which show other examples of outbound and inbound physical port assignments in accordance with the present invention.

FIG. 41 is a block diagram which shows the Packet Forwarding—Cluster Bridge Media in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As will be appreciated by those skilled in the art, communication networks and their operations can be described according to the Open Systems Interconnection (OSI) model which includes seven layers including an application, presentation, session, transport, network, link, and physical layer. The OSI model was developed by the International Organization for Standardization (ISO) and is described in "The Basics Book of OSI and Network Management" by Motorola Codex from Addison-Wesley Publishing Company, Inc., 1993 (First Printing September 1992).

Each layer of the OSI model performs a specific data communications task, a service to and for the layer that precedes it (e.g., the network layer provides a service for the transport layer). The process can be likened to placing a letter in a series of envelopes before it's sent through the postal system. Each succeeding envelope adds another layer of processing or overhead information necessary to process the transaction. Together, all the envelopes help make sure the letter gets to the right address and that the message received is identical to the message sent. Once the entire package is received at its destination, the envelopes are opened one by one until the letter itself emerges exactly as written.

In a data communication transaction, however, each end user is unaware of the envelopes, which perform their functions transparently. For example, an automatic back teller transaction can be tracked through the multilayer OSI system. One multiple layer system (Open System A) provides an application layer that is an interface to a person attempting a transaction, while the other multiple layer system (Open System B) provides an application layer that interfaces with applications software in a bank's host computer. The corresponding layers in Open Systems A and B are called peer layers and communicate through peer protocols. These peer protocols provide communication support for a user's application, performing transaction related tasks such as debiting an account, dispensing currency, or crediting an account.

Actual data flow between the two open systems (Open System A and Open System B), however, is from top to bottom in one open system (Open bottom to top in the other open system (Open System B, the destination). Each time that user application data passes downward from one layer to the next layer in the same system more processing information is added. When that information is removed and processed by the peer layer in the other system, it causes various tasks (error correction, flow control, etc.) to be performed. The user is unaware of any of this, of course, but in fact that's what's happening while the words, "Please wait, your transaction is being processed" appears on the screen.

The ISO has specifically defined all seven layers, which are summarized below in the order in which the data actually flow as they leave the source:

Layer 7, the application layer, provides for a user application (such as getting money from an automatic bank teller machine) to interface with the OSI application layer. That OSI application layer has a corresponding peer layer in the other open system, the bank's host computer.

Layer 6, the presentation layer, makes sure the user information (a request for $50 in cash to be debited from your checking account) is in a format (i.e., syntax or sequence of ones and zeros) the destination open system can understand.

Layer 5, the session layer, provides synchronization control of data between the open systems (i.e., makes sure the bit configurations that pass through layer 5 at the source are the same as those that pass through layer 5 at the destination).

Layer 4, the transport layer, ensures that an end-to-end connection has been established between the two open

systems and is often reliable (i.e., layer 4 at the destination "confirms the request for a connection," so to speak, that it has received from layer 4 at the source).

Layer 3, the network layer, provides routing and relaying of data through the network (among other things, at layer 3 on the outbound side an "address" gets slapped on the "envelope" which is then read by layer 3 at the destination).

Layer 2, the data link layer, includes flow control of data as messages pass down through this layer in one open system and up through the peer layer in the other open system.

Layer 1, the physical interface layer, includes the ways in which data communications equipment is connected mechanically and electrically, and the means by which the data move across those physical connections from layer 1 at the source to layer 1 at the destination.

The first and primary item in the Virtual Routing (VR) toolbox is the notion of a Virtual Router (i.e., virtual switch). Traditionally, multiprotocol bridge/routers have a single version of IP, bridging, IPX, etc. in operation, which coordinates the flow of traffic between all ports activated for the protocol. Single events on one incoming port can simply or profoundly affect the flow of traffic on other ports.

To implement virtual routers, object oriented software techniques are used to create separate instances of multiprotocol bridge/router code residing on the same router platform. Each operates independently of one another and is not directly aware of the existence of other virtual routers.

The simplest example of Virtual Routing consists of the case where the population of physical interfaces 102, 110 on the router 150 is partitioned among the Virtual Routers 152, 154, 156 running in the chassis as shown in FIG. 1. This is a software partitioning, which means that:

All management continues to be done through a single, possibly redundant control processor.

The partitioning of connectivity into Virtual Routers 152, 154, 156 is done on a per interface basis, rather than a per card basis. As we'll see later, the partitioning can be further refined to individual media destinations on selected media.

What this means is that, in a first step, an owner of the multiprotocol bridge/router 150 has now been given three routers 152, 154, 156 for the price of one. If they are servicing the needs of several organizations, the cost of a highly available and manageable enterprise router can be spread over several independent clients.

The cost savings in routers can be significant. However, over time the cost of wide area network services can dwarf the up front router equipment costs. The second step in Virtual Routing is to permit the media 158 to be shared in such a way as to give each Closed User Group the impression that they have a medium to themselves.

A solution can be provided for this problem through the use of remote groups. Remote groups are a means of sharing multipoint wide area networks among several Closed User Groups. This is done rather simply:

Multi-point WAN's such as Frame Relay, X.25 and ATM work with the concept that a media address is prepended to the message payload. This media header is used by the network to determine how the message shall be delivered. Switched networks such as ATM often have a prerequisite signaling process which determines the header to be used to reach a certain destination.

A multipoint WAN interface will remain informed of all the destinations which are currently reachable through the WAN. The WAN internals will refer to them through the media address in the header. The interface is free to send or receive messages from any of these active remote destinations.

The WAN software may be split into two portions: A Framer to maintain the state of the WAN connections, and a set of Remote Groups which are responsible for examining and processing the contents of the message. The Remote Group software more or less believes that it is the exclusive owner of the WAN interface; however the Framer only gives the Remote Group information on the specific media addresses owned by that group.

One of the virtues of Remote Groups is that it does not modify the protocols used to communicate over the shared medium in any way. Specifically, any device capable of talking to the medium can be a member of a Remote Group.

The result of such a configuration of Remote Groups is shown in FIG. 7. A single multipoint WAN has been carved into several multipoint WAN's, each of which may be used to service the needs of a different community. The example Frame Relay network has been split into two independently operating networks. It will be appreciated by those skilled in the art that multiple telecommunication interfaces and local loops to the Frame Relay service could also have provided this connectivity, but at considerably greater expense (i.e., more hardware).

Most significantly, a single multipoint WAN has been taken and divided such that a subset of it is available to each of several Virtual Routers. The administrative isolation of Virtual Routers have now been extended from within a chassis to independently operating systems of routers sharing both common chassis and a media backbone.

So far the discussion has focused on techniques where groups can be entirely sealed from each other. However, there are reasons why these barriers should be partially torn down in the interests of better communications. Examples include:

Permitting access for certain protocol families. For example, Appletalk and IPX are not noted for scaling well over large domains, while IP does a good job of this. Virtual Routing permits the limited area protocols to run fully separately, while the two IP regions are interconnected.

Permitting certain applications to run. For example, many sites are comfortable receiving IP electronic mail traffic from any point, do not wish general access. If traffic moves between domains at a small number of constrained points it is easy to exercise policy at only those points rather than throughout the network.

More than anything else, when moving from one user group to another, a change in access policy can occur. Every group wants to define their own policy for accepting traffic each other group. Thus, a mechanism is needed not only to pass traffic between user groups, but also a means whereby the owners of each user group can define the filtering desired for packets leaving and entering the group.

As shown in FIG. 8, through the use of a networking medium Virtual Routers, which may be real, separate routers, can be connected. Within a chassis containing several Virtual Routers, a point to point link between two of these Virtual Routers can be defined which is a complete software artifact—each Virtual Router defines an interface (i.e., sometimes called a Protocol Port) that is one end of this Virtual Link "pipe". Messages inserted in one end of the pipe logically arrive at an incoming port of the other Virtual Router.

In addition to permitting the raw movement of traffic, Virtual Links permit protocol filters for traffic moving to and from the link. In fact, the filters on these links are often the most important in the design of a network, because a change from one network of routers and Virtual Routers to another coincides with a change in administrative policy as traffic moves from one domain to another.

Virtual Links are seen as point to point links by all networking protocols which reside in the unit. Thus, the Virtual Link can be used to carry IP, IPX, Appletalk and other internetworking traffic. Routing updates from protocols such as DECnet Routing will flow over the Virtual Link to update the routing tables on the other virtual router. This is the only way that the protocols in the separate Virtual Routers can communicate with each other, despite the fact that they run in the set of physical processors.

Forwarding data through a Virtual Link performs all the activity associated with an extra "hop" between two networks. Time to Live counts are decremented and all filters are applied as if it were a real link. However, since a Virtual Link is a software artifact the overhead is small; the forwarding algorithms are applied to the packet in succession when it arrives from an external medium, and it is not moved anywhere until an ultimate destination outside the box is found. Routes that involve packets progressing through multiple Virtual Links within the chassis are both possible and reasonable in complex configurations.

So far a service provider has been permitted to segregate traffic between customers but it is also necessary to manage this segregation. Since "Network Management" means too many different things to different people, a few terms should be defined for this discussion.

Surveillance consists of the act of monitoring the status of network entities. Modifications of network parameters must take place through other channels.

Provisioning consists of the act of modifying the configuration or operation of network equipment, either temporarily or permanently.

Data Privacy in this context means that the client has high assurance that other parties (other than the service provider) cannot intercept the user's data packets. Network Privacy means that the details of the customer's network operations are not available to other customers.

Security in this management context means that no act on the part of another customer, however malicious, will affect operations of the closed user group.

Also, two different techniques are available to survey and provision network equipment:

Simple network management protocol (SNMP), the Internet standard which has an assured place as the de facto technique for the management of all network equipment. SNMP is noted as being pretty effective for surveillance and light duty provisioning. Its limitations are that it cannot survey items specific to a vendor (such as chassis status) or perform massive provisioning (such as initial setup of the unit) without resort to vendor extensions.

CAS (Component Administration System). The internal network surveillance and provisioning system specific to Network Systems Corporation equipment.

Both have their complementary attributes; SNMP is an excellent platform for monitoring the health and status of a remote, network attached device. With the advent of SNMP Version 2, it has become suitable for "tweaking" devices through setting external parameters. A direct dialogue with CAS is better suited for wholesale changes in the configuration of the unit; CAS also permits access to the internal control features of a particular piece of network equipment which are not defined in the standard SNMP vocabulary.

To best take advantage of these complementary features, the following should be done:

Access through CAS has an omniscient view of the box. All components are available for inspection or alteration by properly authorized CAS users. Once a CAS user has read-only or modification rights on the chassis, all parameters of all virtual routers are available.

SNMP users work with a copy of SNMP which is part of their Virtual Router. Proper authorization permits one of two alternative views of the chassis. In "omniscient" mode, they perceive all interfaces in the unit and can modify their parameters. In "local" mode all interfaces are given an interface number for SNMP purposes, but the ones not owned by the virtual router will appear stubbornly offline regardless of their actual status. This permits the actual owner of the router access to the entire interface population, while Virtual Router clients have access to only their own internal interfaces.

SNMP based "core" configuration information not associated with interfaces, such as filtering, IP routing parameters, DECnet node addresses, etc. are only accessible from a host which can reach that Virtual Router. Since SNMP management requires IP, access to this core information requires a Virtual Link or other mechanism giving access to that Virtual Router.

Under no circumstances can an SNMP user modify the router variables for a virtual router other than their own. If such a facility is provided, it can either be done through CAS or by providing access to the SNMP stack of a "distant" Virtual Router through a Virtual Link.

To better understand these principles, the following examples are given.

A purely segregated metropolitan network, shown in FIGS. 9 and 10 will be the simplest example of the set, because the situation is simplest. A utility oriented company, Lightco, happens to own a large fiber optic cable plant that can be used to access local businesses. They choose to offer LAN interconnection services to these businesses as an additional revenue opportunity for themselves.

Because it is an existing proven technology and well suited for the cable plant, FDDI is chosen as the backbone medium. In the example, three enterprises are to be connected to a common FDDI metropolitan area network, with Points of Presence required at three different sites.

The routers at a site serving one client run a single Virtual Router (or one Real Router, if you like). The ones serving two clients run one Virtual Router for each client.

The advantages of Virtual Routing come into more into play when routing (e.g., incorporating public network access) becomes part of the picture. In the hypothetical example, connectivity to the Internet is offered through a drop at the Point of Presence (POP) of an Internet service provider. A Corp. wants unrestricted Internet access (or, more accurately, they will take responsibility for access within their own network). C Corp. wants mail access to a single machine on their network, and B Corp. is not interested in Internet access at all. How can these divergent needs be handled?

One solution is shown in FIGS. 11 and 12. Let us look at the noteworthy items in this new configuration:

The FDDI backbone has been replaced with an ATM backbone. The customer is oblivious to the change

(other than by examining the unit internals through network management). For simplicity, Permanent Virtual Circuits (PVC's) are employed in this metropolitan ATM network. One PVC must be established between every pair of virtual routers that wish to communicate. For example, chassis 224 will require four PVC's. One to the chassis' 224 B Corp. virtual router to the chassis 226, one from chassis 224 A Corp. virtual router to the chassis 230, and one each from the each chassis 224 virtual router to each customer's Virtual Router on the chassis 232.

Each Virtual Router in the chassis 232 is probably administered by the Internet service provider, where they offer the customer the right to inspect the current statistics of that router via SNMP. That Virtual Router takes traffic off the ATM network and performs IP routing on it. That Virtual Router has a single other port with an IP address indicating it belongs on the distribution LAN at the Internet Service provider's POP.

Each Virtual Router serves as a mechanism to filter packets according to the customer's expectations.

For A Corp., filters are installed which permit unlimited access to one specific IP address, and default filters deny Telnet, rlogin, FTP, etc. access from the Internet to all other hosts.

For the more paranoid C Corp., all IP packets directed from the Internet to all hosts but one are denied. On that single host, packets for Simple Mail Transfer Protocol (SMTP) Domain Name Service, and Internet Control Message Protocol (ICMP) are permitted to pass.

Again taking the physical examples above, the technologically progressive A Corp. chooses to switch to a routed backbone as shown in FIG. 13, rather than the bridged backbone in the previous examples. For simplicity, it is assumed that they want to route IP while continuing to bridge "other" traffic. Very little needs to change from the previous example. Steps have already been taken as needed to segregate A Corp.'s traffic from all others, so all that is needed is to concentrate on A Corp.'s concerns within their virtual routers. Thus, if we look at A Corp.'s virtual network in isolation, perhaps giving the situation shown in FIG. 13. The ATM PVC's and bridging parameters stay the same—only IP is activated for the ports on and off the ATM MAN. Open Shortest Path First (OSPF) or Routing Information Protocol (RIP) is run in each of the virtual routers so that automatic route discovery may take place.

This means that the entire idea is that things become simple at this level once virtual routing is in place. It should be noted what has been done in IP terms:

The MAN carrier has isolated the proper portion of their connectivity plant and given it to the customer. The customer is free to assign a subnet that they own to this segment, permitting a routed IP network to be used to interconnect the many subnets which presumably lie at each site. This feat can be duplicated for any desired number of routing customers.

The three routers are SNMP visible to the customer. Given proper authority, they may alter parameters which are settable via SNMP. Since they are isolated to their Virtual Routers the privacy and integrity of other customer's data is unaffected.

Routers supporting traffic for several customers must be routers with Virtual Networking. Routers to service a single customer can be of any make offering suitable connectivity.

The ATM backbone is visible to the customer as an ATM network. If the MAN carrier has a more complex backbone than that, FDDI can be disguised such that the internals of the MAN plant from the customer and have it appear as a "cloud". Native ATM transfers may take place from the same router to service the needs of different customers.

Finally, it should be noted that this more sophisticated customer is using routers of their own as a gateway between their numerous LAN's and the metropolitan access node. A metropolitan service provider which feels up to handling the administrative work might consider offering multiple LAN connections to the user at each site, where traffic is routed between the LAN's at little incremental expense to the client. Since all these LAN's belong to the same Virtual Router, the generally unlimited access policies that exist within a site can be followed while continuing to prohibit access to other clients, even if they share the same physical router. Pricing of such a service has to be aimed so that it is cost effective for the client to not purchase and administer their own router.

So far several cases have been covered where there is an easily well defined vendor and customer relationship between the administrators and users of virtual routing. However, similar situations arise in single organizations where the constituents have differing needs and priorities. This is also known as enterprise networking with divisional autonomy and is shown in FIGS. 14, 15, 16, and 17 from a physical, network topology, virtual routing, and consolidated router point of view, respectively. For example:

Corporations or government agencies with a highly decentralized structure, where each division really wanted its "own" network.

Regional networking cooperatives which maintain a Wide Area Network to be shared by its constituent members.

Let us look at a Corporate problem to see how Virtual Routing techniques may address these issues. For the last example, the case of the recently merged Alpha and Beta divisions of MegaCorp having come to cohabit the same campus. The networking group and the expensive wide area network are run by MegaCorp corporate, but the fiercely independent divisions wish to be isolated from each other. They offer reasons a management consultant might find both good and bad for wanting to do so:

Both have retained their own computer support people who install hosts, servers, and wiring hubs in their respective departments. These people and their managers have gracelessly conceded to a common WAN and campus backbone, but staunchly resist attempts to control how "their" hosts will talk within the division.

For historical reasons, both have different IP network numbers assigned to them.

The Alpha group once paid for a fiber optic connection between two buildings which they will use in preference to the (slower) company routed backbone. They want to use the backbone as backup for their private link, however.

Both run small pockets of Netware (IPX) applications scattered throughout their empires. Hosts have been known to inadvertently access the other division's servers, which was patched up through an elaborate, fragile series of bridge filters.

Both are large Appletalk users, but have no reason to permit Appletalk interconnection.

E-mail is commonly sent between both divisions and Corporate, and there are IP based servers in each which are used to archive information the other division might want or need.

Both want Internet access through Corporate. They will determine access policy to the Internet within their division.

To give the problem a tangible feel and a sense of reality, an illustration of the physical systems is shown in FIG. 14.

There are number of ways to solve these problems. The simplest is the "brute force" approach, where in fact separate network plants are provided for each of our client customers and explicit, physical connections are built between them. One example is shown in FIG. 14. Some of the virtues of this configuration include:

The Appletalk and IPX problem is solved neatly. IP is routed and a Mac layer bridging is used for everything else. Turning on Appletalk or IPX routing in each separate network will present no difficulties if either group independently decides they would prefer to route these protocols.

The fiber link remains the property of Alpha, while the Frame Relay network will continue to work in a pinch.

The vexing IP subnetting rule that you must stay within a subnet to reach any point on it is eliminated. There are entirely separate Frame Relay nets, each with a subnet owned by the separate division.

IP filtering between the two networks is easy to administer. All data moving between the two network arrive at the Corporate router, who halts non-IP traffic and administers policy on the combination of Internet and other division traffic that will enter each divisional domain.

So why not do it this way? To do it the "brute force" way with conventional bridge routers, 5 Frame Relay local loops are needed instead of 3 and 6 Backbone and corporate routers are needed instead of 3.

With a lot of tinkering on "classic" bridge/routers, the ingenious corporate network planner might be able to accommodate these people with a single backbone and some filtering. However any changes will have the habit of bringing the entire house of cards down, causing long service times on the core routers and frequent complaints following maintenance. Clearly a more controllable scheme is desired. A solution involving the construction of a set of filters on a "Brand X" bridge/router which meets the user requirements should be readily understood by those skilled in the art so it will not be provided here.

Using Virtual Routers, a solution to this complex problem becomes more elegant. If the "brute force" configuration is referred to again and viewed from a network topology view as shown in FIG. 15 and reconfigure it in a Virtual Routing environment where the backbone routers are physical routers capable of virtual routing. The result is shown in FIG. 16. This particular "brute force" configuration was deliberately chosen among several brute force options to more easily illustrate the present invention; however, one of ordinary skill in the art will appreciate that these principles can be applied to any "brute force" solution provided they are properly reconfigured into a virtual routing scheme.

Several interesting things are apparent about this configuration, including:

The brute force configuration had 6 backbone routers; now only one at each physical site is used.

There is one Frame Relay connection and local loop per physical site.

The FDDI ring at Corporate has been changed so that traffic for both Alpha and Beta can flow over it.

Connectivity between the different divisions takes place through Virtual Links within the backbone router at Corporate. Filters on the Virtual Links are used to enforce access policy.

The Corporate network lies within a Virtual Router of its own, for administrative convenience.

Even the network shown in FIG. 16 contains more equipment than is strictly necessary. Note that multiple routers are still present at each site; one for the "backbone" and one which is owned by the maintenance personnel of each division. If these disparate network management groups become sufficiently trusting (or consolidated) that they can be persuaded simply to leave other Virtual Routers alone when configuring their network, then the configuration can be reduced to the consolidated block diagram shown in FIG. 17. To reach this configuration, the redundant routers have been eliminated and the Corporate FDDI ring has been replaced with a set of fiber optic repeaters.

Now different groups share the same router and exercise their different concerns. Is such mutual trust warranted? Again, this brings up the difference between security and integrity—integrity against unintended alterations since each group is dealing with an independent set of IP protocol stacks, management software, and interfaces, and they have no excuse to tinker with those belonging to others. Their interests only conflict when modifying the physical health of the common Frame Relay network they share. However, security is not provided in that one group is not immune from the malicious intent of the other.

Hopefully, these example have shown that there is a new networking problem beginning to emerge-the problem of networking networks, rather than networking hosts as in the past. Just as peer to peer host networks required a different model of what networks were about at the time if its introduction, the interconnection of networks also requires new tools and approaches to be properly implemented.

With the tools discussed above and further discussed below in detail, the present invention provides solutions for this new problem. Additional tools will be required in the future to accommodate exciting new technologies such as wireless, public networks for mobile computing; however, with the proper foundations provided by the present invention it should be readily understood how to deal with such new technologies as they are developed and implemented in the data networking environment.

Referring to once again to FIG. 1, a preferred embodiment of the present invention which provides a packet processing system 150 which contains virtual switches 152, 154, and 156 within physical switching systems 150 that direct the flow of protocol data units into inbound interfaces 102 and out of outbound interfaces 110 in a data communication network is shown. This is similar to the partitioning of a large shared network hard disk into several disk partitions and restricting access by different users to different partition. For example, a 750 Megabyte hard drive can be partitioned into three 250 Megabyte partitions. Further, each partition can be password protected so that only users which know the correct password have access to that hard disk partition. All members of a Closed User Group would know the correct password for the partition assigned to that Closed User Group and no one outside of that group would know the correct password.

In a similar manner, the present invention uses Closed User Groups to provide access to a shared medium data path 158. This access is accomplished by providing protocols, algorithms, and bridge/router architectural designs that are capable of processing packets at multi-gigabyte rates while maintaining appropriate access policies and/or network security measures. By using all of these principles, the

present invention reduces the cost of providing these packet switching services by enabling a single physical data switch 150 to be divided into two or more virtual switches 152, 154, and 156 which individually process packets from different Closed User Groups. With reference to the hard disk partitioning analogy, the following present invention detailed description provides a set of operating techniques, device architectures, and constraints necessary for partitioning a communication network switch, like a hard disk, so that different Closed User Groups can have access to different partitions (i.e., virtual switching devices) while ensuring that access to the different partitions is limited to members of the Closed User Groups.

In a preferred embodiment of the present invention shown in FIG. 2, a physical switching device 150 for use in a communication network to switch OSI network layer protocol data units within the communication network is provided. The physical switching device 150 includes at least a first 152 and a second 154 virtual switch. Each virtual switch 152, 154 includes a decision mechanism 104 for determining an associated directive based on a destination identifier within a particular protocol data unit 140 received at a data port 160. A processor 108 is operatively coupled to each virtual switch 152, 154 to insert the particular protocol data unit 140 into an outgoing data stream on another data port 162 according to the associated directive to enable delivery of the protocol data unit 140 to the destination identifier. These data ports 160, 162 are associated with a set of data interfaces 112, 114, 116, 118, 132, 134, 136, and 138 selected from a plurality of data interfaces in a physical communication network switch 150. The set of data interfaces 112, 114, 116, 118, 132, 134, 136, and 138 is assigned exclusively to a unique virtual switching device 152. These data ports 160, 162 can take many forms, including but not limited to, a data interface 112 on the physical switch 150, a time slot out of several time slots in a time-divided frame received at a data interface 112 (e.g., an FDDI time multiplexed optical fiber) on the physical switch 150, and a code divided cell out of several code divided cells received at one or more data interface 112 (e.g., in ATM cells may be sent over several different paths and reassembled in a sequence based on a cell identifier within the cell header information) on the physical switch 150. In addition, two or more data ports 195 and 197 can be associated with one or more data interfaces and retrieve protocol data units from the data interface data stream for each data port 195 and 197 based on unique attributes (e.g., destination identifiers) associated with a particular data port.

The physical switching device 150 preferably is designed to accommodate data interfaces of differing types such that the set of data interfaces assigned to a virtual switch 152 may include a first data interface 114 which manipulates a protocol data unit having a different protocol type from a second data interface 116 such that protocol data units of different protocol types can be switched within a single virtual switch 152. The different protocol data unit protocol types may differ by having differing OSI physical layer media types, differing OSI link layer signaling protocols, and/or differing OSI network layer protocols.

A management apparatus 164 is operatively coupled to each virtual switch 152, 154 to maintain information on an association between the plurality of data interfaces and the virtual switches. The management apparatus 164 includes a controller 166 dependent on the association information for limiting the processor 108 of each virtual switch 152, 154 to only inserting the particular protocol data unit 140 into an outgoing data stream on another data port 162 associated with the same virtual switch 152 which received the particular protocol data unit 140.

Further, it is desirable for the management apparatus 164 to have a reassigning mechanism 168 for changing a set assignment of particular data interface 118 such that the particular data interface assignment 170 can be moved between the virtual switching devices 152 and 154 as needed (i.e., the data port 160 can be moved).

Furthermore, it is necessary for the management apparatus 164 to maintain a database 172 of known destination identifiers and to require verification that the destination identifier in the particular protocol data unit 140 is in the database 172 prior to inserting the particular protocol data unit 140 into an outgoing data stream on another data port 162 such that delivery of the protocol data unit 140 to an unknown destination identifier is prevented.

Each virtual switch processor 108 preferably performs restructuring and/or monitoring operations on the particular protocol data unit 140. The restructuring operations include deleting, inserting, and/or replacing bits in the particular protocol data unit 140 in accordance with the associated directive prior to inserting the particular protocol data unit 140 into the outgoing data stream. The monitoring operations include dropping, sending, sending a copy of, and/or auditing the contents of the particular protocol data unit 140 in accordance with the associated directive prior to inserting the particular protocol data unit 140 into the outgoing data stream.

In accordance with an alternative embodiment of the present invention shown in FIG. 3, a physical switching device 150 for use in a communication network to switch protocol data units within the communication network on a shared communication medium is provided. The physical switching device 150 includes at least a first 152 and a second virtual switch 152 which is similar to that which was described in the preferred embodiment of the present invention; however, the management apparatus is different. This different management apparatus is a virtual link management apparatus 174 which is operatively coupled to the virtual switches 152, 154. The virtual link management apparatus 174 maintains information on at least one virtual link 176 between at least the first 152 and the second 154 virtual switches. The virtual link 176 has a first end 178 and a second end 180 of a data path 182 on the shared communication medium 158.

The virtual link 176 provides a data path 182 between the first 152 and the second 154 virtual switches on the shared communication medium 158. The first 152 and the second 154 virtual switches preferably are located in a single geographic location (i.e., within the same network hardware device rack) and the shared communication medium 158 preferably is a memory shared between the first 152 and the second 154 virtual switches.

Alternatively, the first 152 and the second 154 virtual switches may be geographically remote from one another. In addition, the first 178 and the second 180 virtual link ends may be in a single set of data ports assigned exclusively to the first 152 and the second 154 virtual switches such that the virtual link 176 provides a data path 182 between the first 152 and the second 154 virtual switches on the shared communication medium 158 across a geographic distance. In this alternative arrangement, the shared communication medium 158 preferably consists of a high data transfer rate link between the first 152 and the second 154 virtual switches which spans the geographic distance.

In addition, filters 184 and 185 (associated with virtual switch 152 and 154, respectively) may be operatively

coupled to the data path 182 which filters protocol data units communicated in the virtual link data path 182. Each filter 184 or 185 performs filtering operations according to one access policy out of a plurality of access policies that are separately specified for each virtual switch.

The present invention may also be described in reference to yet another preferred embodiment shown in FIGS. 2 and 4. Referring to FIG. 4, a communication system 190 which delivers OSI network layer protocol data units within a first 186 and a second 188 virtual closed user group on a shared communication medium 158 is provided. It will be noted that the shared communication medium 158 may include a variety of physical communication media (as shown in FIG. 4), in addition to other intermediate network bridges, routers and the like. The communication system 190 includes a first virtual closed user group processor 152 for examining and modifying data bits within a protocol data unit received from a member of the first virtual closed user group 186 on the shared communication medium 158. Each member of the first virtual closed user group 186 has a unique destination identifier. As shown in FIG. 2, the first virtual closed user group processor 152 includes a delivery mechanism 108 for delivering the modified protocol data unit 140' to another member of the first virtual closed user group 186.

As shown in FIG. 4, the communication system 190 also includes a second virtual closed user group processor 154 which is similar to the first virtual closed user group processor 152. The second virtual closed user group processor 154 examines and modifies data bits within a protocol data unit received from a member of the second virtual closed user group 188 on the shared communication medium 158. Also, each member of the second virtual closed user group 188 has a unique destination identifier. In addition, as shown in FIG. 4, the second virtual closed user group processor 154 includes a delivery mechanism 108' for delivering the modified protocol data unit 141' to another member of the second virtual closed user group 188.

A framer 164 is operatively coupled to the first 152 and the second 154 virtual closed user group processors to maintain a database 192 of all destination identifiers currently reachable for delivery of protocol data units within the communication system 190. This framer 164 preferably requires verification that each destination identifier in a protocol data unit on the shared communication medium 158 can be currently reached for delivery through a lookup in the database 192, prior to completing delivery of the protocol data unit to the associated destination identifier. The framer 164 preferably further limits access to the database 192 such that each virtual closed user group 186, 188 only has access to specific destination identifiers owned by that particular virtual closed user group 186 or 188 so that a protocol data unit having a destination identifier which is not owned by the particular virtual closed user group 186 or 188 will not be delivered.

Each virtual closed user group processor 152, 154 modifies and/or monitors protocol data units. The processor 152 modifies data bits within a received protocol data unit by deleting, inserting, and replacing bits in the received protocol data unit prior to delivering the modified protocol data unit to another member of the same virtual closed user group. The processor 152 monitors the received protocol data unit by dropping, sending, sending a copy of, and auditing the contents of the received protocol data unit prior to delivering the modified protocol data unit to another member of the same virtual closed user group.

In addition, each virtual closed user group processor 152, 154 may deliver the modified protocol data unit to another destination within the same virtual closed user group without modifying the predetermined OSI physical layer, link layer, and network layer access protocols used to communicate protocol data units over the shared communication medium. This provides seamless integration of this closed user group functionality to LAN managers even though the LANs may be operating within a MAN as separate closed user groups. This lack of modification of the access protocols also has the advantage of enabling each virtual closed user group processor 152, 154 to allow any particular device capable of communicating on the shared communication medium (e.g., port with a destination identifier) to be a member of either virtual closed user group by having the framer 164 limit database 192 access to destination identifiers associated with a particular destination within a particular desired virtual closed user group.

The framer 164 preferably also includes a mechanism for assigning incoming protocol data unit traffic to each virtual closed user group 186, 188 based on an access policy that is separately specified in each virtual closed user group.

In the preferred embodiment communication system 190 operations of the first 152 and the second 154 virtual closed user group processor are performed by a first 152 and a second 154 virtual switch, respectively. Each virtual switch 152, 154 includes a decision mechanism 104, 104' for determining an associated directive based on a destination identifier within a particular protocol data unit 140, 141 received at a data port 160, 194. In addition, each virtual switch 152, 154 includes a processor 108, 108' which performs the functions of the virtual closed user group delivery mechanism by inserting the particular protocol data unit 140, 140' into an outgoing data stream on another data port 162 or 196 according to the associated directive to enable delivery of the protocol data unit 140 or 141 to the destination identifier within the protocol data unit.

In an alternative embodiment to this preferred embodiment described in reference to FIGS. 2 and 4, the operations of the first virtual closed user group processor 152 are divided between a first and a second virtual switch. This spreads the processing load between two virtual switches and takes into account typical communication system configurations which have many geographically separate physical switches 150, 150' devoted to the same closed user group (e.g., group 186).

In either embodiment, the first 152 and the second 154 virtual switch may be located within a single physical switching device 150. These data ports 160 and 162 as well as 194 and 196 for each virtual switch are then from a set of data interfaces in the physical switching device 150 assigned exclusively to the same virtual switch 152 and 154, respectively.

Also in either embodiment, the first 152 and the second 154 virtual switches may be located within different physical switching devices 150 and 150'. These data ports 160 and 162 as well as 194' and 196' (data ports 194' and 196' for virtual switch 154' are not shown, but are the same as those shown in FIG. 2) for each virtual switch are then from a set of data interfaces in the respective physical switching devices 150 and 150' which are assigned exclusively to the same virtual switch 152 and 154'. As noted above, the different physical switching devices 150 and 150' may be geographically remote from one another.

As previously noted, these data ports 160, 162, 194, and 196 may be either a data interface 112 on a physical switching device 150, a time slot out of several time slots in a time-divided frame received at a data interface 112 on a physical switching device 150, or a code divided cells out of

several code divided cells received at at least one data interface 112 on a physical switching device 150. In addition, two or more data ports 195 and 197 can be associated with one or more data interfaces and retrieve protocol data units from the data interface data stream for each data port 195 and 197 based on unique attributes (e.g., destination identifiers) associated with a particular data port.

In addition, as previously noted, the physical switching device 150 preferably is designed to accommodate data interfaces capable of manipulating different protocol types such that each set of data interfaces assigned to a virtual switch 152 may include two or more data interfaces 114, 116 having mechanisms for manipulating protocol data units having different protocol types and the virtual switch 152 is configured to switch protocol data unit coming from these data interfaces 114, 116 with different mechanisms. The differences in the protocol data unit data protocol types may include differing OSI physical layer media types, differing OSI link layer signaling protocols, and/or differing OSI network layer protocols.

Also, as previously noted, Each virtual switch processor 108 modifies and/or monitors protocol data units.

In addition, the communication system 190 may include a virtual link 76 between the first 152 and the second 154 virtual switches. This virtual link 176 consists of a first end 178 and a second end 180 of a data path 182 on the shared communication medium 158, where each end 178, 180 is a data port in a different virtual closed user group 186, 188. To enforce access policies a pair of filters 184 and 185 may be operatively coupled to the data path 182 to filter protocol data units communicated in the data path 182 based on individual access policies that are separately specified for each virtual closed user group.

The present invention virtual switching apparatus and method are integrated into a particular communication network device that forwards packets. The following discussion details this integration; however many of the forwarding operations are more thoroughly discussed in the previously identified related U.S. patent application Ser. No. 08/366,221 entitled "Method And Apparatus For Accelerated Packet Forwarding".

Referring to FIGS. 2 and 5, a preferred embodiment of a forwarding system 100 in which a protocol data unit preprocessor 104 (also termed a fast packet processor (FPP)) is used in a protocol data unit forwarding device 108 that operates in a communication network to transfer protocol data units (e.g., 140) within the communication network. The forwarding device 108 manipulates bits of information at the OSI network, link and physical layers and preferably performs as one or more network devices including, but not limited to, a bridge, a router, a switch, a line filter, a protocol converter, an encapsulating device, and a security device. It will be appreciated that various types of communication networks exist which utilize forwarding devices that perform these functions including local protocol data unit source devices (e.g., desktop computers or workstations), local area networks, wide area networks, metropolitan area networks, and wireless networks. Also, it will be appreciated by those skilled in the art that the forwarding device 108 may perform other network-based functions without departing from the scope and spirit of the present invention. In addition, other types of data in the communication network could readily be manipulated by the forwarding device 108.

The forwarding device 108 includes an inbound interface 102 and outbound interface 110 which control the flow of protocol data units 140 and 140' into and out of the forwarding device 108, respectively. These interfaces 102 and 110 are configured differently depending on the type of communication network that the forwarding device 108 is connected to as well as the particular location within such a network that the forwarding device 108 is located.

Turning now more specifically to FIG. 5, an example of how the decision mechanism 104 may be implementing within the forwarding device 108 is shown. The preprocessor 104 (i.e., one possible form of decision mechanism 104) includes an identifier 122 which determines media header information of a protocol data unit received from over the communication network. The identifier 122 preferably analyzes the inbound stream of data bits from the inbound interface 102 to find media header information of a protocol data unit 140 received from over the communication network. In addition, a validation mechanism 124 is operatively coupled to the identifier 122 to validate the media header information. Also, a modifier device 126 is operatively coupled to the identifier 122 to add next operation information in the form of an associated directive 142 to the media header information based upon the determined media header information such that subsequent processing of the protocol data unit 140 by a protocol data unit forwarding processor 108 is reduced. This next operation information preferably includes bits necessary to enable the use of two or more virtual switches inside a single physical switching device. The modified media header information including the associated directive 142 along with the remaining portion of this particular protocol data unit 140 are then stored in a memory buffer 106 until the forwarding processor 108 is able to process this particular protocol data unit. The forwarding processor 108 is operatively coupled to the preprocessor 104 and the memory buffer 106 to forward the protocol data unit 140' without the modified media header information in the communication network based upon the next operation information contained in the associated directive 142. It should be noted that the next operation information will differentiate between protocol data units for the first 152 and second virtuals switches 154, and may include header modification or truncation of the protocol data unit 140 prior to forwarding. The memory buffer 106 works in conjunction with the forwarding processor 108 and the outbound interface 110 to accomplish this task as preferably as a real-time operation.

The media header information typically includes at a minimum the encapsulation type, protocol type, frame type, media destination, and source route information. This information is used by the modifier device 126 to add next operation information 142 which specifies a particular operation such as route, bridge, or source route bridge to perform on the received protocol data unit. It should be noted that a media destination may be multicast, a unicast match, or a unicast non-match destination.

In order to accelerate the forwarding of a received protocol data unit 140, the identifier 122 preferably is configured to determine the media header information after having received only a portion (i.e., the first several bits or bytes) of the protocol data unit 140. Similarly, the modifier device 126 preferably is configured to add next operation information 142 to the media header information after having received only a portion of the protocol data unit 140. Both of these optimizations are particularly important when manipulating large protocol data traits which are simultaneously received from various incoming interfaces 102.

The preprocessor 104 preferably includes a mechanism for aligning the contents of buffer memory 106. This can be accomplished by the modifier device 126 padding bytes of data to the protocol data unit 140 such that the header

information is aligned on optimal boundaries. The reasons for doing this optimal boundary alignment are discussed in the following sections.

The preprocessor 104 identifier 122 preferably includes an address lookup mechanism for obtaining various addresses required by the preprocessor 104 through the use of a content addressable memory 128 (CAM) located in the forwarding processor 108. The addresses can be obtained through several types of algorithms. For example, a network destination address of the protocol data unit 140 can be compared to a predetermined list of known network destination addresses. Also, a media destination address of the protocol data unit 140 can be compared to a predetermined list of known media destination addresses. Further, a media source address of the protocol data unit 140 can be compared to a predetermined list of known media destination addresses. Furthermore, a media source address of the protocol data unit 140 can be compared to a predetermined list of known media source addresses.

The preprocessor 104 identifier 122 also preferably includes a source route bridge destination lookup mechanism for checking for specifically routed protocol data unit 140, finding next local area network identifier in a source route of the protocol data unit 140, and comparing the next local area network identifier to a predetermined list of known local area network identifiers by utilizing the CAM 128.

The present invention also can be described in reference to a device-implemented method steps 200–218 shown in FIG. 6 to deliver protocol data units within a first 186 and a second 188 virtual closed user group on a shared communication medium 158 in a communication system 190 (i.e., shown in FIG. 4). This delivery method includes maintaining 202 a database of all destination identifiers currently reachable for delivery of protocol data units within the communication system. Access to this database is limited 204 such that each virtual closed user group only has access to specific destination identifiers owned by that particular virtual closed user group. Incoming traffic is assigned 206 to each virtual closed user group based on an access policy that is separately specified in each virtual closed user group. The access policy may be as simple as having all members with last names beginning with the letters A-1 being placed in one group and all others being placed in another. Further, the access policy may be more complex. For example, member group assignment could be based on an IP address, plus a known security clearance level, and a time of day to which access is limited (i.e., only during standard working hours).

At this point, the operations are split between the first and the second virtual closed user groups such that any further processing is performed separately. Data bits within a protocol data unit received from a data interface on the shared communication medium are examined and modified 208 wherein the protocol data unit has a unique destination identifier associated with the first virtual closed user group to form an associated directive for that protocol data unit. In a similar manner, data bits within a protocol data unit received from a data interface on the shared communication medium are separately examined and modified 208' when the protocol data unit has a unique destination identifier associated with the second virtual closed user group to form an associated directive for that protocol data unit. Each member of the second virtual closed user group also has a unique destination identifier.

Also, verification 210 and 210' that each destination identifier in a protocol data unit on the shared communication medium is currently reachable by the particular virtual closed user group for delivery is required This verification may be accomplished through a lookup in the database prior to completing delivery of the protocol data unit to the associated destination identifier. If a destination identifier is not found in the database, three possible actions can be taken, including: dropping the associated protocol data unit so that no delivery occurs, forwarding the associated protocol data unit to another destination identifier, or adding this non-verified destination identifier to the database. This last possible action also has other benefits in that any particular device capable of communicating on the shared communication medium can be a member of either virtual closed user group by simply adding 212 or 212' a destination identifier associated with the particular device newly attached to the communication network to the database and associating the device with the first or the second virtual closed user group, respectively.

Subsequently, the first virtual closed user group modified protocol data unit is delivered 214 to another member of the first virtual closed user group after verifying that the first virtual closed user group member destination identifier is currently reachable. In addition, the second virtual closed user group modified protocol data unit is delivered 214' to another member of the second virtual closed user group after verifying that the second virtual closed user group member destination identifier is currently reachable.

These device-implemented steps 200–218 preferably are performed such that all predetermined physical layer, link layer, and network layer access protocols used to communicate protocol data units over the shared communication medium are preserved. In other words, no changes to protocol like IP, ATM, OC-12 or the like are necessary to implement the present invention, because these steps are seamlessly integrated with this access protocols.

In addition, the device-implemented steps may include a step of providing 216 a virtual link between the first and the second virtual closed user group. This virtual link can be used to deliver protocol data units from the first virtual closed user group and to the second virtual closed user group. The virtual link includes a first end and a second end of a data path on the shared communication medium. Also, each virtual link end includes a data port in a different virtual closed user group. A shared memory can be used as the shared communication medium to provide the virtual link. Alternatively, a high data transfer rate link which spans a geographic distance between the first and the second virtual closed user group can be utilized to provide the virtual link. A filtering process can be performed on the virtual link such that protocol data units communicated in the virtual link data path are filtered according to an access policy that is separately specified in each virtual closed user group. It will be appreciated by those skilled in the art that another virtual link may be provided to deliver protocol data units from the second virtual closed user group to the first virtual closed user group.

Mode for Carrying Out the Invention

The following sections describe in detail the features required for the virtual router/switch. It should be noted that the packets described herein refer to protocol data units which can take the form of a packet, cell, or frame of data. The Virtual Router feature provides a means of segregating Upper Layer Protocols and their ports into several groups or "virtual" routers. These virtual routers can function almost totally independent of one another preventing traffic mix, or allowing controlled access amongst one another.

The following describes the customer viewable aspects of the Virtual Router. This includes the Virtual Router (VR) component and all of its immediate subcomponents. In particular, the following details regarding the VR are described:

Component Definitions;

Provisionable attributes;

Operational attributes;

Provisioning commands; and

Provisioning procedures.

Some of the primary benefits of the Virtual Router include:

Multiple Virtual Routers per platform

Service Providers: Provides ability to share the resources of one platform across many customers. Obvious benefits include cost reduction and integrated maintenance.

Large Enterprises: Provides ability to segregate local traffic and resources between organizations while sharing the more expensive long haul resources among organizations. Again benefits here include centralized maintenance and reduced cost.

Controlled interaction between Virtual Routers—The VR provides for traffic segregation and controlled integration. Integrated traffic can be precisely controlled regarding its source, destination among many other possibilities.

Single maintenance platform—Provides a constant and integrated management interface for each Virtual Router on the platform. This simplifies the management of the set of VRs.

The Virtual Router (VR) provides the customer with the ability to segregate router traffic and maintenance into what appears to be separate physical routers. This is accomplished by the creation of multiple instances of the VR component directly under CASROOT.

Each instance of the VR component provides support for multiple network protocols, routing protocols and media devices to operate virtually independently of each other.

The VR system includes the VR component and many other subcomponents. These sections provide the complete specifications of the following components:

Virtual Router;

Protocol Port; and

Memory Management.

These sections describe the subcomponents under the VR, including the number and type of subcomponents which can exist directly under the VR and Protocol Port (PP) Components.

The Virtual Router component resides directly under CASROOT. Multiple instances of the VR component may exist. Components which reside under the one VR component are independent of components under another VR. The network protocol and protocol port components reside under the VR component. This allows multiple instances of protocol stacks to exist on one platform. The network protocol component represents an instance of that particular protocol and all of its configured data.

Protocol Ports (PPs) are created under the VR and represent a logical interfaces to a network. There can be multiple protocol ports under each VR, each having any number of protocols enabled. To allow for the processing of particular OSI Network Layer Protocol packets on a PP, a Network Protocol Port subcomponent is created under the PP. A CAS linkage, from the PP to a Media Application component, is used to associated the logical PP to a physical media. Each PP must be linked to a Media Application component. The linkage between PPs and Media Application components is a one to one linkage.

An example of a component hierarchy including three Virtual Routers and multiple protocol stacks and protocol ports is shown in FIG. 18. The VR has many subcomponent, many of which also have subcomponents. FIG. 19 is a diagram which shows the entire component hierarchy under the VR. The bold or darker tone components are fully defined in these sections.

VR PPs support both LAN and WAN media. For LAN media, the PP is linked, via a CAS linkage, directly with the LAN Application component. This linkage defines the physical port which the PP is associated with.

For WAN media, the linkage from PP to WAN Application varies depending on the Link Level Protocol (LLP) type. This feature supports two very different types of LLP types. One type of LLP is a Point to Point LLP. A Point to Point (PPP) LLP type provides a 1 to 1 connectivity model. That is each end of the link supports only one end destination. The WAN Applications which use this model include: Point to Point Protocol (PPP) and Vitalink Control Protocol (VCP). For these LLP types, the PP is linked directly with the Application component, e.g. PPP or VCP.

The second type of LLP supported by the VR system is the Multi-point LLP. The multi-point LLPs allow for one interface to be multiplexed into multiple data carrying pipes, each capable of supporting multiple end destinations. The WAN Applications which use this model include: Frame Relay Data Terminal Equipment (DTE), X.25 (DTE), and Switched Multimegabit Data Service (SMDS) (DTE). For all of these LLP types, the PP is linked with a RemoteGroup subcomponent which resides directly under the Application Component.

Networking Protocols (e.g., IP, IPX, etc.) are supported via CAS components which reside directly under the VR component and a Network Protocol Port components which resides directly under the PP component. There can be at most, one instance of each Network Protocol component under each VR component and one instance of each Network Protocol Port component under each PP. These subcomponents provide the functionality required to provide packet processing support for each Network Protocol Type. It is required that for each Network Protocol Port which is provisioned under a PP, that the associated Network Protocol component exist under the VR.

IP is supported per VR with an Ip component and an IpPort component. There can be at most one Ip component under each VR and one IpPort component under each PP. Support for multiple IP addresses per IP protocol port is provided by a subcomponent under the IpPort component. This component contains a list of "secondary" IP addresses which are associated with the IpPort. Routing Protocols (e.g., OSPF and Exterior Gateway Protocol (EGP)) are supported via CAS components which reside directly under the IP subcomponent. Thus the creation of a IP component also provides for the creation of these routing protocols.

IPX is supported per VR with an Ipx component and an IpxPort component. There can be at most one Ipx component under each VR, and one IpxPort component under each PP.

Appletalk is supported per VR with an Appletalk component and an AppletalkPort component. There can be at most one Appletalk component under each VR, and one Appletalk Port component under each PP.

Decnet is supported per VR with an Decnet component and an DecnetPort component. There can be at most one

Decnet component under each VR, and one DecnetPort component under each PP.

Bridging is supported via the Bridging CAS component which resides directly under the VR component. There can be at most, one instance of a Bridging component under each VR component. The creation of a Bridging component under a VR component, allows for the creation of a BridgePort subcomponent under the PP component.

Cluster bridging provides the ability for a group of LAN ports to be bridged for all media, while treating the group of ports as one port which can be used for Telnet and management purposes. Cluster bridging is supported by the VR using two existing components and one new component. The existing Bridge component is still used under each VR to perform the bridging activities. The BridgePort component is used to enable bridging on a PP. This component is used to enable bridging on a standard bridged port and to enable cluster bridging on a cluster bridged protocol port. A standard bridged port is linked to a LAN application which identifies the physical interface which is being bridged. A cluster bridge PP is linked to a new component called a ClusterBridge. This component represents the cluster bridge logical interface and it is what distinguished a PP as being a cluster bridge PP. The ClusterBridge Application component resides directly under the VR. A PP linked to a ClusterBridge Application component (versus a LAN application component) represents a ClusterBridge port. This port acts as a gateway for all bridged PP traffic to routing, and from routing to all bridged PPs.

Multiple cluster bridge ports may be defined, using multiple instances of the ClusterBridge application. Each bridged port can belong to at most one ClusterBridge. Each BridgePort, including cluster bridge PPs, have a domain attribute which identifies the bridge domain that is used by bridging. The bridge domains must be unique per cluster bridge Port. The bridge domain is what determines which bridge ports are associated with specific instances of the ClusterBridge. For example, all bridged ports with domain 5 are associated with the single cluster bridge port with domain 5.

FIG. 20 is an example of multiple cluster bridges, each associated with one bridge PP. Notice the domain numbers for the bridged ports and the cluster bridge ports. Bridged PP/0 is associated with cluster bridge PP/1 and bridged PP/3 is associated with cluster bridge PP/2.

SNMP is one method which can be used to manage the physical and virtual router platform. This method requires VR support for the SNMP agent(s) which reside under Access Control. The VR provides mechanisms which allow each VR to be managed virtually independently of one another. The SNMP support is provided on a per VR basis with respect the VR components and software. If SNMP support is required, an SNMP component can be provisioned under the VR component. This component contains the ifTable and SnmpSystemGroup. The ifTable includes an ifTable entries for each interface in the VR The SnmpSystemGroup contains generic configuration information per VR for SNMP.

The SNMP administrative status and OSI state must both be supported since it is desired to support both SNMP and OSI. The OSI state is purely an operational attribute while the SNMP admin state is a provisionable attribute. This is the only difference between the SNMP admin state and OSI admin state. The issue here is how these states can affect each other and how they are to be dealt with. The particular state dependencies are well known in the art and for simplicity will not be repeated herein.

The Packet Control Facility (PCF) provides a mechanism to monitor and control the flow of packets through the router platform. This facility is provided on a per VR basis. A PCF component can be produced under the VR which provides the mechanisms and functionality to create, and apply PCF filters.

The following section will describe the memory management for the VR. The major concern for memory management (MM) is to prevent a VR or one of its Network Protocols from using so much memory that it begins to affect the other VRs or protocols adversely. A required Memory-Management component is created under the VR which allows for the configuration of Memory Management. The memory management component allows for the management of both the VR and its Network Protocols.

The memory management for the VR is primarily designed to prevent one VR from obtaining an amount of memory which adversely affects other VRs. MM attributes allow for a percentage of total heap space to be provisioned as the maximum amount of memory which the VR and its subcomponents can obtain. The total heap space for the system is calculated during initialization. It includes the amount of heap space remaining after the standard part of system initialization and prior to the initialization of the provision dependent processes. There are no restrictions on the percentage of heap space any VR can allocate. In fact the total heap space for the platform may be overallocated. For example, three VRs VR/0, VR/1 and VR/3 may each allocate 50% of the heap space on the platform. Allowing this has some apparent advantages and disadvantages. An apparent disadvantage is that a VR may be denied memory before it reaches its maximum memory amount. However, the maximum memory amount is just that, a maximum and it is not to be implied that it is also a guaranteed minimum. An advantage of over allocating memory is that it allows for VRs to share heap space. on a first come first serve basis.

When a VR attempts to allocate an amount of memory which would exceed the maximum allowed, it will be denied. In addition to the denial of memory, an alarm will be triggered. The alarms are filtered such that no more than one alarm per VR will exist per period of time. This period of time is a provisional attribute.

The MM for a VR can be a very powerful tool in controlling the affects of an errant VR on other VRs. In order to efficiently provision the memory maximums, the user must know how much memory a VR is using under normal situations. To provide access to this data, operational attributes are provided which lists the amount of heap space is currently in use per VR.

Because the maximum share of memory is a provisioned attribute, it can be adjusted to include more memory or less memory. If the provisioned amount is increased, MM automatically adjusts the amount allowed to the VR and Protocols. If the amount of memory is decreased, no action is taken by MM to automatically retrieve memory from VRs which now exceed that amount. If it is necessary to reduce the amount of memory used by a VR or protocol, the VR can be administratively disabled and enabled. This restarts the VR, thus requiring them to adhere to the new provisioned values for maximum heap space usage.

The memory management for Network Protocols work much like the MM for VRs. Separate attributes within the same MM allow for Network Protocol memory management. A provisioned attribute for each protocol determines the percentage of heap each protocol can use. However this share, unlike the VR share, is in terms of VR heap space versus total heap space. So if a VR has a provisioned fair

share of 50%, and a protocol has a fair share of 50%, the protocol has at most, the capability of getting 25% of the total heap space of the system.

The Network Protocol memory management includes the same type of alarm reporting and current memory usage counts as described above for the VR. Similar to the VR situation, if the provisioned share of memory used by a protocol is decreased, a protocol could be in violation of it share of the memory. Although it has more memory than it should have, all subsequent requests for memory will be denied. If it determined that this is a problem, the situation can be corrected by disabling the protocol and re-enabling it. Otherwise the protocol may be in violation until either the protocol reduces it memory consumption for another reason, or the system reboots.

A MemoryManagement component exists under the VR to contain all the attributes associated with VR and Network Protocol memory management. The MemoryManagement component is a required subcomponent, which has default values for each of its attributes.

These sections detail the ability to support multiple VRs on one router platform. In addition, it also provides a means of internally connecting these VRs such that they can transmit packets between one another. This capability is be referred to as inter-VR support and is shown in FIG. 21.

In the standard intra-VR case, a VR protocol port is linked to a media application component. This linkage explicitly defines the physical port, and implicitly the FP, the logical port is associated with.

In the inter-VR case, the PP has no physical port or media which connects the two VRs. A mechanism must be devised to replace the functionality provided by the physical port and connection. The two most obvious alternatives were to either connect the VRs via a Virtual LAN media or a Virtual Point to Point Link media.

An inter-VR connection can be achieved by creating two protocol ports, one on each VR, and connecting them via a Virtual Link component. The two protocol ports connected to the Virtual Link component are considered inter-VR (IVR) PPs. Although the Virtual Link is a logical mediun versus a physical medium, it is what is used to interconnect the two VRs.

Provisioning a Virtual Router consists of provisioning multiple components, most notably the Virtual Router (VR) as well as its subcomponents (Upper level Protocols, SNMP, Bridges and Protocol Ports). The Virtual Router is used to logically separate sets of protocol ports and protocols into what appear to be and act like distinct routers/bridges. Most of the components required to operate the platform as a router or bridge either reside under the VR or are linked to the VR via a CAS linkage. This allows the creation of multiple instances of these components on a per Virtual Router basis.

The Virtual Router (VR) component resides directly under CAS Root. The base software set allows for the creation of only one VR. However since part of the optional software set, allows for multiple VRs, the VR must always have an instance identifier. Preferably the maximum number of VRs allowed is 16; however, this number is totally arbitrary and changing it to a larger or smaller number should be a trivial operation. The identifier for the VR is a string of up to 20 characters.

To allow for inter-VR packet processing, VirtualLinks are used. A VirtualLink allows for the connection of at most two VRs. The VirtualLink component resides directly under CAS Root and can be linked to two Protocol Ports through a provisioning procedure. CAS checks ensure that both linkages are established and that they are between two different VRs.

The following caveats are a result of the implementation of the VR on this preferred embodiment router platform:

The provisioning system is not VR centric—Because only one edit view exists for all CAS components, multiple VR provisioning sessions are not possible. Additionally, CAS command security between VRs is not supported.

Resource Contention—Hardware and Software resources are shared across VRs, thus certain conditions on one VR may affect the performance of another VR.

Each instance of a Virtual Router requires the creation of many components and processes. This obviously has a significant impact on memory usage. Depending on may variables, including the number of protocols supported per VR, the number of Protocol Ports created and the size of the dynamic routing tables created based on the network design, the memory usage may vary. Thus the number of VRs which can be successfully provisioned and made operational is nondeterministic. Several features which, if provisioned, may significantly affect the amount of memory used. The primary memory user is Multiple Virtual Routers. Each instance of a VR uses a significant amount of memory depending on the number of protocols, protocol ports and media types being used.

The use of the following features may have create some level of performance degradation compared to the optimal performance characteristics:

ClusterBridging—Because cluster bridging requires both a bridging and a routing step, the performance regarding forwarding a packet via a ClusterBridge port can be reduce to half the normal rate.

Inter-Virtual Router Packet Forwarding—The process of forwarding a packet from one VR to another includes forwarding a packet out a IVR PP for one VR, in the IVR PP for the destination PP and finally out a physical PP. This process includes at least two forwarding table lookups, and one mapping from the inbound VR to the outbound VR. This process in some cases can be split across FPs, thus incurring additional performance penalties.

The following sections are the System Description for the Virtual Routing System which provides for the creation and execution of multiple Virtual Routers on a physical router platform. It also includes what is called "Protocol Glue". This is the software which provides a common set of interfaces and support mechanisms for the Network Protocols to run within.

The Virtual Router (VR) feature has two major parts. The first part, is to provide the functionality required to support multiple Virtual Routers on a single physical router platform. The second part is to provide a common set of interfaces and support mechanisms for the network protocol processes.

The VR is primarily intended for customer premises applications where a single chassis may operate separate networks for multiple clients. This allows an internetworking service provider to support multiple clients, multiple networks while sharing hardware. Traffic can be cross-connected between VRs using Virtual Links. Virtual Links act like Point to Point media for InterVirtual Router connections.

In the following sections, Network Protocols, ULPs, and Protocols are used to refer to the same thing, (i.e., IP, IPX, Decnet, AppleTalk, etc.). The terms Media Applications and Applications are used to describe the Media component

processes (i.e., Ethernet, FDDI, TokenRing, FrameRelay, etc.). The term "event" is used extensively throughout this section. An event identifies any external stimuli to a process or object. An event can be a Process Environment (PEV) message or a function call. The term Protocol Port (PP) is used extensively and it refers to PPs in general. There are many different types of PPs, used in different components and processes in addition to the PP component itself. If a specific PP type is being referred to, its specific type is used.

The Virtual Router system consists of several classes. The three major classes which represent PEV processes are the VirtualRouterProcess, ForwardingAgentProcess and the NetworkProtocolBaseProcess classes. These processes are shown in FIG. 22 along with the sub-processes which they interact with. In particular, the following sub-processes are shown:

Component Administration System (CAS);

Packet Control Facility (PCF);

Process Control System (PCS);

Component Name Server (CNS);

Global Stats Manager (GSM);

Global Cache Manager (GCM);

Local Cache Manager (LCM); and

Local Stats Manager (LSM).

The VirtualRouterProcess class encapsulates the control processor (CP) data and functionality associated with each instance of the VR. The VR processes reside on the CP. One VR process is created by CAS for each VR provisioned on the platform. The VR process creates network protocol processes for each provisioned Protocol under the VR.

This class provides the mechanisms required to handle all CP related activities as required by the protocol processes, the protocol ports and other objects which require VR support.

The ForwardingAgentProcess class provides the functionality required by the VR system on each active Logical Processor (LP) on the router platform, including the CP. This class provides the process which acts as the VRs agent on the Logical Processors (LPs). The VR uses these processes in order to provide each LP with forwarding data and other initialization required by the protocol.

The NetworkProtocolBaseProcess Class provides a common platform for which each network protocol process is built on. This platform provides a common set of interfaces to all processes interacting with the protocol processes. Having a common interface for all network protocols reduces the effort and complexity of system components which interface to all the protocol types.

Protocol registration is initiated by the Network Protocol processes. It is an indication to the VR that the Protocol is active and wishes to begin receiving locally addressed packets. In addition to this, it provides the VR with Protocol specific forwarding information (transparent to the VR), which is required on the LPs for packet forwarding. This data is made available to the protocol specific data path objects on each LP via the VR/Forwarding Agent (FA) processes. Included in this Protocol registration message is the forwarding information, the process ID of the process which is to receive local packets for the protocol, and an indication of the state of the protocol (active/inactive). The protocolState is required since this message is being used for registration and deregistration.

Protocol processes require notification that the media interface is available prior to initiating a bind request. This notification originates from the Media Application component once instantiated.

Media Application processes (e.g. ENET, FrameRelay, etc.) are created on LPs (in the general case) and on the CP (for the ClusterBridge and Inter-VR Link cases) during CAS provisioning. These applications have CAS linkage to a PP. When a Media Application process becomes active, it registers with the Virtual Router on the CP. Included in the registration message is the data required by the forwarding Data Manipulation Engine (DME) (i.e., frame handler) regarding the physical interface type, maximum packet size, etc.

Upon reception of the message, the VR saves the data regarding a PP in the VRs PP object. This data is sent down to the FA and made available to the forwarding software. In addition to this, the VR sends a mediaAvailability message to each protocol which is provisioned under this PP. Once this message is received by the protocol processes, they can bind to the PP.

Protocol Port Binding is a procedure used by a network protocols to enable or start packet processing on a PP for a particular protocol type. For example, prior to IP binding to PP/5, all IP packets on PP/5 are either bridged (if bridging is active) or dropped. Once IP binds to PP/5, IP packets are processed by the IP forwarder.

Because the forwarding software is on the LP and the network protocol processes are on the CP, the VR provides a mechanism to support protocol binding. Binding is initiated by the network protocol process via a bind request delivered to the VR via a PEV message. The VR then determines which LP(s) the PP resides on, and forwards the Bind request to the appropriate FA(s). Bind data, passed by the network protocols, is used during the creation of the Bind Table Manage (BTM) on the LP. A BTM is required on each LP which can process inbound packets. For PP which have physical interfaces, the BTM is required on the LP where the physical interface resides. For PPs that have no physical interface (e.g. ClusterBridge) and PPs that have multiple physical interfaces more than one LP requires a BTM.

The FA, upon reception of the bind request, creates a BTM (if necessary) and delivers the bind request to it. In addition, a ProtocolPort object is created using the data included in the bind request by the protocol process. This ProtocolPort provides all the information required by the forwarding software to process packets on this interface.

Before network protocol DMEs can be used on the LP, they must be created. A DME must be created on each LP for each bound Protocol. The VR and FA assist in the creation of these DMEs.

Protocols have semi-global data which is required to forward packets. This is the data which is not PP specific, but protocol specific. This data is passed to the VR in the protocol registration message. This data is forwarded to the LPs and a pointer to this data is passed to the function which is called to do the protocol LP initialization.

Each protocol must provide a function (a forwardingEventHandler) which can handle forwarding events initiated by the protocol process. This function must be able to handle each of the protocolForwardingEvent types (ProtocolEnabled, ProtocolDisabled and Protocol Updated). The ProtocolEnabled event triggers the initialization of the protocols LP forwarding data (including the creation of the protocols DME). The function is called prior to creating the first PP for a particular protocol on each LP. This function, which is to be provided by the network protocol, must be made available on the LP. As the saying goes, "everything that goes up must come down". When a protocol deregisters, a function is called to disable the initialization done for the protocol and remove the DME for the protocol.

To enhance the performance of forwarding packets on the router platform, all packet processing required to forward a packet on some LAN media is done on the inbound board. Because of this, the forwarding software on an LP not only requires information about all the PPs on the LP, but also for all the PPs for which it can transmit out on other LPs. This PP information, distributed across multiple LPs for a port on one LP is called "Distributed Protocol Port Data". This data is required on each LP prior to forwarding the first packet. The data is forwarded to the LPs when the LP became active and the Media Application registers with the VR. The data is sent to the LP for each PP on the VR.

When the distributed PP data arrives on the LP, the FA creates a ProtocolPort object. This object contains all the data necessary for the forwarding software to forward a packet.

The Protocol Port (PP) is a very significant part of this system. It represents a logical interface to a network. The term PP has many different connotations. There is the PP component which resides under the VR. There is also a Network Protocol Port component which is specific to a particular network Protocol type. In addition to these PP components there are VR PP objects, Network Protocol Port objects and Forwarding Agent Protocol Port Objects. Each of the PP objects require a slightly different view of the PP. For example, the VR is interested in the protocol independent portion of the PP. The protocol processes are interested in the protocol dependent portion of the PP, and the forwarding DME software is interested in yet a different portion of the software (in fact, forwarding software on LPs that contain the physical interface associated with a PP require different information than those on the other LPs). In addition to all of this, the PP information is distributed across multiple processes, not to mention multiple processors.

The following protocol port object types exist, including: VrProtocolPort, NetworkProtocolPortBase (also one derived version for each Protocol type), FaInboundProtocolPort, and FaOutboundProtocolPort.

The VrProtocolPort provides the data and functionality required for the PP by the VR process. This includes all PP data which is common across all protocols. This data can be broken down into two categories, inbound and outbound. The inboundPpForwardingData is a structure of common data required by the inbound forwarding software. The outboundPpForwardingData structure contains data common to multiple protocols required by the outbound forwarding software. These two structures along with methods which are used to update the contents of them, make up the VrProtocolPort.

The NetworkProtocolPortBase class provides protocol processes with a base class which is be used to encapsulate protocol specific forwarding data. This forwarding data, in terms of protocol specified objects, is turned into contiguous bytes of data, transmitted to the LPs and reincarnated into their original form again. Once back into the object form, they can be used by the forwarding software to forward datagrams. This base class is meant to provide a common interface to the VR so that the data can be turned into contiguous bytes which are sent to the FAs, where they are reincarnated back into objects of their original form.

The FaOutboundProtocolPort class provides the data and functionality required on LPs which need outbound PP data in order to forward the packet. This class contains the protocol independent outboundPpForwardingData structure from the VR as well as the protocol specific outboundForwardingData provided by the protocol process.

The FaInboundProtocolPort class is inherited from the FaOutboundProtocolPort class. This class provides both the inbound and outbound data required forwarding software. This class is used on LPs where inbound packets can be processed, thus requiring inbound forwarding data in addition to the outbound forwarding data. In addition to the outbound data provided by the base class (FaOutboundProtocolPort), this class contains the protocol independent inboundPpForwardingData structure from the VR as well as the protocol specific inbound forwarding data provided by the protocol process.

The following section describes the initialization procedures provided by the VR system on both the CP and LP.

The Virtual Router requires no pre-provisioning CP initialization. All VR initialization is performed during or after VR provisioning. The Virtual Router system requires system initialization on the LP. The Virtual Router system requires a process on the LP which acts as an agent for the VR on the LP. This agent process, called the Forwarding Agent (FA), is created during LP initialization. This process immediately registers itself with the Component Name Server (CNS) so that other processes have access to its PID.

The following section describes high level details regarding the processing of messages from CAS. The VR process handles CAS messages for itself and all of its subcomponents. When a provisioning message is received by the VR for a subcomponent which requires a process, the VR creates the process, and forward the CAS provisioning message to that process. In this case, it is the responsibility of the subcomponent process to handle the provisioning message appropriately and provide the acknowledgment to CAS. CAS messages which are addressed to the VR or to components which do not have processes are processed by the VR.

A Virtual Router Process is created by CAS for each provisioned VR. Once the process is created, CAS sends all provisioned information for a VR to the VR process. The VR creates a process for each provisioned protocol. Once the process is created, the VR sends all the provisioning messages for the protocol to the protocol processes.

The VR system primarily consists of two processes, the VR process and the FA process. The VR process is created by CAS as the appropriate CAS messages are delivered. The FA process is created by fixed process initialization on each LP. Forwarding packets for a particular protocol over any media requires a certain amount of initialization. The initialization procedure required can be different depending on the type of media a PP is connected to. This section discusses the initialization required by each of the various media types and the packet forwarding process associated with them. For the standard case (i.e., LAN media), the per port initialization required prior to packet forwarding includes Virtual Router Creation and Provisioning as shown in FIG. 23. The following steps must be accomplished.

A1. CAS Create and Provisioning messages—The VR process is created by CAS and all VR provisioning messages (including all of those for VR subcomponents) are sent to this process.

A2. Each CAS provisioning message received by the VR for protocol subcomponents (including PCF and SNMP) are forwarded to those subcomponents processes. (The standard CAS provisioning message is used and forwarded to the protocol processes)

A3. The ProvDone message from CAS indicates that CAS has finished sending CAS provisioning message to the VR for this CAS session.

A4. The VR sends a ProvDone message to each of its subcomponents processes indicating to them that CAS has finished send provisioning messages for this CAS session. (The standard CAS provisioning message is used and forwarded to the protocol processes)

A5. Prior to giving up control of the Execution Engine (EE), the VR sends a PEV message to the CNS registering its process ID. (The standard CNS registration message type is used)

A6. After the Protocol Processes receive the ProvDone message, it can register with the VR. This registration indicates the protocols acceptance of local packets and the process ID which is to receive them.

In addition, LAN Media Application Creation and Initialization must be accomplished prior to packet forwarding as shown in FIG. 24. The following steps must be accomplished.

B1. CAS Create and Provisioning messages—The Media process is created by CAS and all provisioning messages are sent to this process.

B2. The ProvDone message from CAS indicates that CAS has finished sending CAS provisioning message to the Media for this CAS session.

B3. The Media application requests the process ID associated with the VR process. A linkage attribute in the Media Application defines the VR which is associated with this media. (The standard CNS registration message type is used)

B4. Some time later, the process ID associated with the request csVR is returned to the Media Application process. This event does not occur until event A5 has occurred. (The standard CNS registration message type is used)

B5. The Media Application registers with the VR. This notifies the VR of the Media's availability and process ID.

Also, Forwarding Data Distribution—LAN Media must be accomplished as shown in FIG. 25. The following steps must be accomplished.

C1. This event depends on event B5 having occurred. The Create Protocol Port event sends the generic protocol port information associated with one or more protocol ports to the relevant set of LPs. If this is the first PP which is created on this LP, PP information for all registered PPs are also sent to this LP. If this is not the first PP which is created on this LP, only the PP information for the registered PP is sent to this LP. The relevant set of LPs is all LPs which have a physical interface in the VR.

C2. Call the Media ForwardingEventHandler—Pass the Media Forwarding Data. The Media FEH creates the Media DME and any other Media required entities.

C3. If the LP which receives the create PP message is in the inboundLpSet, a FaInboundProtocolPort object is created, otherwise a FaOutboundProtocolPort object created.

C4. If the LP which receives the create PP message is in the inboundLpSet, create a BindTableManager and a fast BindTableManager and store pointers to then in the FaInboundProtocolPort object.

C5. If the ifEntryRegistration field is set in the faCreateProtocolPort message, space is allocated in Local Stats Manager (LSM) for the ifEntry. (LSM provides the message for this event.)

C6. Update the physicalPortInfo Structure—Set the pointer to the FaPP which is associated with the physical channel.

Also, Protocol Binding—LAN Media must be accomplished as shown in FIG. 26. The following steps must be accomplished.

D1. This event can only occur after event B5 occurs. B5 is the MediaRegistration event which indicates the media for the specified PP is available. This event notifies each protocol which is provisioned under the specified protocol port of the media's availability.

D2. The protocol, upon receipt of this mediaAvailability message can bind to a PP. This binding determines the actions which should occur for packets received for the specified protocol type.

D3. The BindProtocolPort event is used to send the bind information associated with the individual protocols to the appropriate LPs. Included in this bind information is Protocol Forwarding Data and Protocol Specific PP Forwarding Data. Protocol Forwarding Data includes the data specific to each protocol which is required by the forwarding software to forward packets. this information was included in the Protocol Registration (event A6). The Protocol Specific PP Forwarding Data includes forwarding data required by each protocols forwarding software which is associated with an individual PP.

D4. If the Protocol has not yet been enabled on this LP, the appropriate Protocol ForwardingEventHandler is called.

D5. The following events can occur in any order. Update the PP forwarding data in the FaPP. Also, Register with the Local Cache Manager (LCM) (Message is to be provided by the LCM).

D6. Update the state of the BTM—Update the forwarding state for the BTM.

At this point, packets received by the Frame Source can be forwarded. The forwarding process works as shown in FIG. 27 (i.e., Packet Forwarding—LAN Media).

E1. The dispatcher pulls a packet off the inbound packet queue and calls the appropriate Media frame source with the physical channel number which the packet came from.

E2. The Frame Source gets a pointer to the Inbound PP object via the physicalPortInfo structure maintained by the FA.

E3. The inbound Media DME is called to process the packet.

E4. The protocol Forwarding DME is determined via the BTM. The inbound PP object has a pointer to the BTM.

E5. The protocol forwarding DME is called. The appropriate protocol processing is done.

E6. The protocol forwarding DME does a cache lookup to determine the outbound PP for which the packet is to be transmitted out. (Part of the cache entry is a pointer to the FaProtocolPort object)

E7. The outbound Media DME is retrieved from the FaProtocolPort object.

E8. The outbound Media DME is called to process the packet.

E9. The appropriate media processing is done and the packet is transmitted out the interface.

The major difference between the standard LAN case and the standard WAN case (not including PPP/VCP in the standard WAN case) is that the WAN case has its own mapping table from inbound packet to inbound PP. In the LAN case, the mapping to a PP is based on the inbound physical channel. For the RemoteGroup WAN case, the mapping to the PP object is based on data inside the packet (e.g. Frame Relay DLCI or Data Link Connection Indicator). The WAN component must initialize a table based on the mapping data to a ppId. The WAN media has a mapping from DLCI to PP instance ID, but they do not know what the PPID is associated with the PP instance. This is required to get a pointer to the PP object via the logicalPortInfo table supported by the FA. The WAN media gets the PP instance ID to PPID mapping from the VR during the createProtocolPort event. If the createProtocolNotification flag is set, the FA sends a notification to the WAN which includes the PP instance ID and the PPID.

Shown in FIG. 28 is the PP initialization for the multipoint WAN media (i.e., Media Application Creation and Initialization—Multi-point WAN). The following steps must be accomplished.

B1. CAS Create and Provisioning messages—The Media process is created by CAS and all provisioning messages are sent to this process.

B2. The ProvDone message from CAS indicates that CAS has finished sending CAS provisioning message to the Media for this CAS session.

B3. The Media application requests the process ID associated with the VR process. A linkage attribute in the Media Application defines the VR which is associated with this media. (The standard CNS registration message type is used)

B4. Some time later, the process ID associated with the request csVR is returned to the Media Application process. This event does not occur until event A5 has occurred. (The standard CNS registration message type is used)

B5. The Media Application registers with the VR. This notifies the VR of the Media's availability and process ID. The createProtocolPortNotification field is set to ensure the Media Application is notified of the PPID when it is created on the LP.

Also, Forwarding Data Distribution—Multi-point WAN must be accomplished as shown in FIG. 29. The following steps must be accomplished.

C1. This event depends on event B5 having occured. The Create Protocol Port event sends the generic protocol port information associated with one or more protocol ports to the relevant set of LPs. If this is the first PP which is created on this LP, PP information for all registered PPs are also sent to this LP. If this is not the first PP which is created on this LP, only the PP information for the registered PP is sent to this LP. The relevant set of LPs is all LPs which have a physical interface in the VR.

C2. Call the Media ForwardingEventHandler—Pass the Media Forwarding Data. The Media FEH creates the Media DME and any other Media required entities.

C3. If the LP which receives the create PP message is in the inboundLpSet, a FaInboundProtocolPort object is created, otherwise a FaOutboundProtocolPort object created.

C4. If the LP which receives the create PP message is in the inboundLpSet, create a BindTableManager and a fast BindTableManager and store pointers to then in the FaInboundProtocolPort object.

C5. If the ifEntryRegistration field is set in the faCreateProtocolPort message, space is allocated in LSM for the ifEntry. (LSM provides the message for this event.)

C6. Update the logicalPortInfo Structure—Set the pointer to the FaPP which is associated with the PP identifier (PPID).

C7. Send a CreateProtocolPort notification to the Media Application. This notifies the Media of the PPs creation and the PPID associated with it.

Also, Protocol Binding—Multi-point WAN must be accomplished as shown in FIG. 30. The following steps must be accomplished.

D1. This event can only occur after event B5 occurs. B5 is the MediaRegistration event which indicates the media for the specified PP is available. This event notifies each protocol which is provisioned under the specified protocol port of the media's availability.

D2. The protocol, upon receipt of this mediaAvailability message can bind to a PP. This binding determines the actions which should occur for packets received for the specified protocol type.

D3. The BindProtocolPort event is used to send the bind information associated with the individual protocols to the appropriate LPs. Included in this bind information is Protocol Forwarding Data and Protocol Specific PP Forwarding Data. Protocol Forwarding Data includes the data specific to each protocol which is required by the forwarding software to forward packets. this information was included in the Protocol Registration (event A6). Also, the Protocol Specific PP Forwarding Data includes forwarding data required by each protocols forwarding software which is associated with an individual PP.

D4. If the Protocol has not yet been enabled on this LP, the appropriate Protocol ForwardingEventHandler is called.

D5. The following events can occur in any order. Update the PP forwarding data in the FaPP. Also, Register with the LCM (Message is to be provided by the LCM).

D6. Update the state of the BTM—Update the forwarding state for the BTM.

At this point, packets received by the Frame Source can be forwarded. The forwarding process works as shown in FIG. 31 (i.e., Packet Forwarding—Multi-point WAN).

E1. The dispatcher pulls a packet off the inbound packet queue and calls the appropriate Media frame source with the physical channel number which the packet came from.

E2. The Frame Source gets a pointer to the Inbound PP object via its own mapping from DLCI to PPID and then from PPID to PP object pointer via the logicalPortInfo structure maintained by the FA.

E3. The inbound Media DME is called to process the packet.

E4. The protocol Forwarding DME is determined via the BTM. The inbound PP object has a pointer to the BTM.

E5. The protocol forwarding DME is called. The appropriate protocol processing is done.

E6. The protocol forwarding DME does a cache lookup to determine the outbound PP for which the packet is to be transmitted out. (Part of the cache entry is a pointer to the FaProtocolPort object)

E7. The outbound Media DME is retrieved from the FaProtocolPort object.

E8. The outbound Media DME is called to process the packet.

E9. The appropriate media processing is done and the packet is transmitted out the interface.

Shown in FIG. 32 is the PP initialization for the Point to Point Protocol (PPP) WAN Media (i.e., Media Application Creation and Initialization—PPP WAN). The following steps must be accomplished.

B1. CAS Create and Provisioning messages—The Media process is created by CAS and all provisioning messages are sent to this process.

B2. The ProvDone message from CAS indicates that CAS has finished sending CAS provisioning message to the Media for this CAS session.

B3. The Media application requests the process ID associated with the VR process. A linkage attribute in the Media Application defines the VR which is associated with this media. (The standard CNS registration message type is used)

B4. Some time later, the process ID associated with the request csVR is returned to the Media Application process. This event does not occur until event A5 has occurred. (The standard CNS registratinn message type is used)

B5. The Media Application registers with the VR. This notifies the VR of the Media's availability and process ID. The bindProtocolPortNotification field is set to ensure the Media Application is notified when the PP is bound to. This value is stored in the VR PP.

Also, Forwarding Data Distribution—PPP WAN must be accomplished as shown in FIG. 33. The following steps must be accomplished.

C1. This event depends on event B5 having occured. The Create Protocol Port event sends the generic protocol port information associated with one or more protocol ports to the relevant set of LPs. If this is the first PP which is created on this LP, PP information for all registered PPs are also sent to this LP. If this is not the first PP which is created on this LP, only the PP information for the registered PP is sent to this LP. The relevant set of LPs is all LPs which have a physical interface in the VR.

C2. Call the Media ForwardingEventHandler—Pass the Media Forwarding Data. The Media FEH creates the Media DME and any other Media required entities.

C3. If the LP which receives the create PP message is in the inboundLpSet, a FainboundProtocolPort object is created, otherwise a FaOutboundProtocolPort object created.

C4. If the LP which receives the create PP message is in the inboundLpSet, create a BindTableManager and a fast BindTableManager and store pointers to then in the FaInboundProtocolPort object.

C5. If the ifEntryRegistration field is set in the faCreateProtocolPort message, space is allocated in LSM for the ifEntry. (LSM provides the message for this event.)

C6. Update the physicalPortInfo Structure—Set the pointer to the FaPP which is associated with the physical channel.

Also, Protocol Binding—PPP WAN must be accomplished as shown in FIG. 34. The following steps must be accomplished.

D1. This event can only occur after event B5 occurs. B5 is the MediaRegistration event which indicates the media for the specified PP is available. This event notifies each protocol which is provisioned under the specified protocol port of the media's availability.

D2. The protocol, upon receipt of this mediaAvailability message can bind to a PP. This binding determines the actions which should occur for packets received for the specified protocol type.

D3. The BindProtocolPort event is used to send the bind information associated with the individual protocols to the appropriate LPs. Included in this bind information is Protocol Forwarding Data and Protocol Specific PP Forwarding Data. The mediaApplicationBindNotification field is set in this message. The Protocol Forwarding Data includes the data specific to each protocol which is required by the forwarding software to forward packets. this information was included in the Protocol Registration (event A6). The Protocol Specific PP Forwarding Data includes forwarding data required by each protocol's forwarding software which is associated with an individual PP.

D4. If the Protocol has not yet been enabled on this LP, the appropriate Protocol ForwardingEventHandler is called.

D5. The following events can occur in any order. Update the PP forwarding data in the FaPP. Also, register with the LCM (Message is to be provided by the LCM).

D6. Update the state of the BTM—Update the forwarding state for the BTM.

D7. A bind notification is sent to the media Application.

At this point, packets received by the Frame Source can be forwarded. The forwarding process works as shown in FIG. 35 (i.e., Packet Forwarding—PPP WAN).

E1. The dispatcher pulls a packet off the inbound packet queue and calls the appropriate Media frame source with the physical channel number which the packet came from.

E2. The Frame Source gets a pointer to the Inbound PP object via its own mapping from DLCI to PPID and then from PPID to PP object pointer via the logicalPortInfo structure maintained by the FA.

E3. The inbound Media DME is called to process the packet.

E4. The protocol Forwarding DME is determined via the BTM. The inbound PP object has a pointer to the BTM.

E5. The protocol forwarding DME is called. The appropriate protocol processing is done.

E6. The protocol forwarding DME does a cache lookup to determine the outbound PP for which the packet is to be transmitted out. (Part of the cache entry is a pointer to the FaProtocolPort object)

E7. The outbound Media DME is retrieved from the FaProtocolPort object.

E8. The outbound Media DME is called to process the packet.

E9. The appropriate media processing is done and the packet is transmitted out the interface.

The Virtual Link is a medium which supports Inter-Virtual Router connectivity. That is the ability to interconnect two Virtual Routers. Although it is possible to do this using a real LAN connection and two physical ports, this mechanism provides the same functionality without the involvement and expense of hardware.

This section describes the VR requirements to support Inter-Virtual Router (IVR) links. Multiple solutions were conceived regarding methods of logically connecting VRs. The solution chosen was to use a point to point model called a "VirtualLink".

Forwarding a packet from one VR through another VR and out a physical interface requires forwarding data (local cache and protocol port information) for both VRs, the inbound VR and the outbound VR. Two alternatives were discussed regarding the location of forwarding data on the VRs. One solution was to put forwarding data on all LPs which could potentially send a packet out a VR. Given this alternative, each LP had to have routing data for VRs which had physical interfaces on its LP as well as VRs which it was connected to via IVR links. This solution was not deemed usable because of the amount of memory it required.

The second solution was to provide only the routing data for VRs supported by this LPs physical interfaces. This would eliminate the need to have routing data for all VRs which could be reached via IVR links. The major disadvantage with this solution is that total packet processing could not be achieved on one LP for IVR packets. If the inbound LP did not have physical interfaces for the outbound VR, it would not have routing data for the outbound VR, thus the packet would have to be sent to an LP which had the data. This requires an additional amount of effort to forward a packet, however the impact of performance for IVR packets doesn't seem to be a major concern.

Virtual Link Data identifies the remote PP and VR associated with a IVR PP. This data exists in the Virtual Link component. Because the Virtual Link component is under casRoot (thus the VR does not get the data for it), it must send this data to both VRs involved and is stored in the appropriate PP objects. This requires a VirtualLinkMedia process to accept the CAS provisioned data and forward it to the VRs.

The second part of the Virtual Link data is data which identifies which LPs have forwarding data for each VR/protocol pair. This data is stored in on each VR in an object called VirtualLinkData. The Virtual Link Data consists of a two dimensional array indexed by LP number and VR number. The data is learned by the VR, and forwarded to all LPs. When this data is received on the LPs, the FA determines the LP to be used for packet processing for each IVR PP on the LP. To determine the LP to be used, a forward search of the array starting with the current LP is done until

an LP is found that supports the destination VR. Using this method, the current LP always is used if possible. (The virtualLink data is forwarded to LPs if one or more PPs are registered with Virtual Link Media)

The Virtual Link Media Application is used to support inter-VR links. The Virtual Link Media initialization process is identical to the process used by the LAN media. However there are some difference in the packet forwarding process. The packet forwarding process for Virtual Link (VL) media is shown in FIGS. 36 and 37. The following steps must be accomplished.

E1. The dispatcher pulls a packet off the inbound packet queue and calls the appropriate Media frame source with the physical channel number which the packet came from (This is the standard physical PP, not the IVR PP).

E2. The Frame Source gets a pointer to the Inbound PP object via the physicalPortInfo structure maintained by the FA.

E3. The inbound Media DME is called to process the packet.

E4. The protocol Forwarding DME is determined via the BTM. The inbound PP object has a pointer to the BTM.

E5. The protocol forwarding DME is called. The appropriate protocol processing is done.

E6. The protocol forwarding DME does a cache lookup to determine the outbound PP for which the packet is to be transmitted out. (Part of the cache entry is a pointer to the FaProtocolPort object)

E7. The outbound Media DME is retrieved from the FaProtocolPort object.

E8. The outbound Media DME is called to process the packet. This is the outbound media application DME for the IVR PP.

The IVR media outbound DME determines the far end VR. This information is part of the PP forwarding data.

The packet context is changed, specifically the VR number is changed to the destination VR and the inbound PP number is changed to the IVR PP number.

The IVR media outbound DME determines which LP has routing information for this protocol and this VR. (This information is provided by the VR in the VirtualLinkData table. A forward search is done of the table by VR and LP number. The first LP found which supports this VR and protocol is used.)

E9. The packet is sent to the LP identified in the previous step (if the current LP supports the destination VR, then this step is skipped)

E10. If the packet was forwarded to another LP, the packet is received by the dispatcher, and the Frame Source is called.

E11. The Frame source determines that this is an IVR packet and gets a pointer to the inbound PP associated with the inbound PPID.

E12. The inbound Media Application DME is called (this is the IVR media inbound DME).

E13. The protocol type is determined, and the protocol DME is retrieved from the BTM.

E14. The protocol DME is called to forward the packet.

E15. The protocol DME does the appropriate packet processing including a cache lookup on the destination address in the packet. A successful cache lookup provides a pointer to the outbound PP for which the packet is to be transmitted.

E16. The outbound Media DME is retrieved from the PP object.

E17. The protocol DME fragments the packet if necessary and transmits it out the outbound PP by calling the outbound media DME as identified in the PP structure.

E18. The Media Application outbound DME adds the appropriate media header and sends the packet out the interface.

The Virtual Link simulates the transmission of a packet out an interface of one VR and the reception of the packet on an interface on the destination VR. A packet which is received on an interface is sent to the appropriate forwarder based on the packet type and the bind information associated with the inbound PP. The forwarder, based on routing information, determines the outbound PP is a IVR PP. The packet is transmitted out the PP (via the outbound media DME). It is the responsibility of the IVR PP Media DME to get the packet to a LP which has routing data for the destination VR. This information if provided by the FA in the VirtualLinkData object. If the current LP has the appropriate routing data, the packet is given back to the forwarding software with an updated frame descriptor which includes a new VR ID and new inbound PPID. The forwarding software can then restart the packet forwarding process using the routing data of the outbound VR. Shown in FIG. 38 is an example where the outbound physical port is on the same LP as the inbound physical port.

If the LP which to packet was received on does not have the routing data for the outbound VR, the packet must be transmitted to an LP which does. Again the outbound IVR PP is responsible for getting the packet to an LP which supports the outbound VR. If the current LP does not support the outbound VR, the PP sends the packet to a LP which does. Once the packet is received on the LP which has appropriate routing data, the packet forwarding process is restarted using the new VR ID and incoming PP ID. See an example in FIG. 39. In this example, the outbound PP is an IVR PP which is connected to VR/1. LP1 does not have routing data for VR/1, so the packet must be sent to a LP which does have the routing data, in this case LP2. If the destination LP is not the same as the current LP, the packet could possible traverse three LPs before exiting the platform. This happens if the inbound LP does not support the outbound VR and the packet is sent to another LP for forwarding. On the second LP, the forwarding is done using the destination VR LCM. The outbound PP may be on another LP, which would be the third LP. See this example involving three LPs in FIG. 40.

A ClusterBridge (CB) port can act as a gateway for all bridged ports in the VR to routing and visa versa. The objective is to allow protocol packets to be freely bridged between LAN interfaces, with the freedom of packets destined for the Media Access Control (MAC) Address of the Cluster bridge to be routed outside of the bridge set. The ClusterBridge port is similar to the IVR PP in that it is a distributed PP. The inbound PP data for CB PP must exist on all LPs supporting the VR. This is required on all LPs with bridging so that packets can be bridged to it and routed out of it. It is required on all LPs with routing so that packets can be routed to it and bridge out of it.

The VR process provides a mechanism which sends inbound and outbound data (FaInboundProtocolPort) to all LPs for distributed PPs. The FA provides this data to the forwarding software upon request.

In order for this to operate successfully with bridge ports, the Cluster Bridge port Bind, Incoming and Outgoing port information is required on every LP which has a bridged port on it per VR.

ClusterBridge Media is used to support Cluster Bridging. The initialization required prior to packet forwarding is identical to that of the LAN case. (The only special case involved here is that the CB PP is a distributed PP. That is it must exist on all the LPs which contain bridged ports of the same domain. To simplify the PP forwarding data

distribution software, this data is placed on all LPs in the VR.)

However, the process used to forward packet is changed somewhat. This process is identified in FIG. 41 as Packet Forwarding—Cluster Bridge Media. In this example, a packet which is received on a routed port is to be transmitted out a bridged port. The following steps must be accomplished.

E1. The dispatcher pulls a packet off the inbound packet queue and calls the appropriate Media frame source with the physical channel number which the packet came from.

E2. The Frame Source gets a pointer to the Inbound PP object via the physicalPortInfo structure maintained by the FA.

E3. The inbound Media DME is called to process the packet.

E4. The protocol Forwarding DME is determined via the BTM. The inbound PP object has a pointer to the BTM.

E5. The protocol forwarding DME is called. The appropriate protocol processing is done. (This is the standard bridging DME). The protocol forwarding DME does a cache lookup to determine the outbound PP for which the packet is to be transmitted out. (There is a static entry in the bridging cache which points to the CB protocol port. At this point, a flag is set in the frameDescriptor which identifies this packet as being originated from bridging)

E6. (Part of the cache entry is a pointer to the FaProtocolPort object)

E7. The outbound Media DME is retrieved from the FaProtocolPort object.

E8. The outbound Media DME is called to process the packet.(This is the ClusterBridge outbound DME).

E9. The CB outbound DME determines if the packet originated from bridging or routing. If it originated from bridging, the protocol type is decoded and the protocol DME is determined via the Bind Table.

E10. The protocol DME is called.

E11. The protocol DME does the appropriate packet processing including a cache lookup on the destination address in the packet. A successful cache lookup provides a pointer to the outbound PP for which the packet is to be transmitted.

E12. The protocol DME fragments the packet if necessary and transmits it out the PP by calling the outbound DME as identified in the PP structure.

E13. The Media Application outbound DME adds the appropriate media header and sends the packet out the interface.

E14. The appropriate media processing is done and the packet is transmitted out the interface.

Beyond initialization and provisioning as described above, it is also desirable to have interface statistics easily retrievable. This can be accomplished in one of several manners known to those of ordinary skill in the art. For example, SNMP may be used as the framework to set up and retrieve this information in a timely fashion.

It will be appreciated by those skilled in the art that the VR system processes including the Virtual Router Process, the Forwarding Agent Process, and the Network Protocol Base Process may each have several components which have specific events that must be acted upon. However in view of the preceding discussion concerning the packet processing and forwarding process which includes virtual routers and virtual links, the software code necessary to accommodate these events in accordance with the present invention should be well within the understanding of a person of ordinary skill in the art. As such no further discussion needs to be provided concerning these events.

Although the invention has been described and illustrated with a certain degree of particularity, it is understood that the present disclosure of embodiments has been made by way of example only and that numerous changes in the arrangement and combination of parts as well as steps may be resorted to by those skilled in the art without departing from the spirit and scope of the invention as claimed.

What is claimed is:

1. A physical switching device for use in a communication network to switch Open Systems Interconnection (OSI) network layer protocol data units within the communication network, the physical switching device comprising:

(a) at least a first and a second virtual switch, each virtual switch comprising decision means for determining an associated directive based on a destination identifier within a particular protocol data unit received at a data port, each virtual switch further comprising processing means for inserting the particular protocol data unit into an outgoing data stream on another data port according to the associated directive to enable delivery of the protocol data unit to the destination identifier, both data ports being associated with a set of data interfaces selected from a plurality of data interfaces in a physical communication network switch, the set of data interfaces being assigned exclusively to a unique virtual switch;

(b) management means, operatively coupled to each virtual switch, for maintaining information on an association between the plurality of data interfaces and each virtual switch, the management means comprising control means dependent on the association information for limiting the processing means of each virtual switch to only inserting the particular protocol data unit into an outgoing data stream on another data port associated with the same virtual switch which received the particular protocol data unit.

2. The physical switching device of claim 1 wherein each data port is selected from the group consisting of protocol data units arriving on a data interface having unique attributes, a data interface on the physical switch, a time slot out of several time slots in a time-divided frame received at a data interface on the physical switch, and a code divided cell out of several code divided cells received at at least one data interface on the physical switch.

3. The physical switching device of claim 1 wherein the set of data interfaces associated with a virtual switch includes a first data interface including means for manipulating a protocol data unit having a different protocol type from a second data interface such that protocol data units of different protocol types can be switched within a single virtual switch, the different protocol data unit protocol types being selected from the group consisting of different Open Systems Interconnection (OSI) physical layer media types, different OSI link layer signaling protocols, and different OSI network layer protocols.

4. The physical switching device of claim 1 wherein the management means further comprises means for maintaining a database of known destination identifiers and means for requiring verification that the destination identifier in the particular protocol data unit is in the database prior to inserting the particular protocol data unit into an outgoing data stream on another data port such that delivery of the protocol data unit to an unknown destination identifier is prevented.

5. The physical switching device of claim 1 wherein each virtual switch processing means comprises means for restructuring the particular protocol data unit by deleting,

inserting, and replacing bits in the particular protocol data unit in accordance with the associated directive prior to inserting the particular protocol data unit into the outgoing data stream.

6. The physical switching device of claim 1 wherein each virtual switch processing means comprises means for monitoring the particular protocol data unit by dropping, sending, sending a copy of, and auditing the contents of the particular protocol data unit in accordance with the associated directive prior to inserting the particular protocol data unit into the outgoing data stream.

7. The physical switching device of claim 1 wherein:

(a) the physical switching device further comprises means for performing operations selected from the group consisting of bridge, route, switch, in-line filter, protocol conversion, and a security function;

(b) the protocol data unit is selected from the group consisting of a frame, a cell, and a packet;

(c) the communication network is selected from the group consisting of local area network, wide area network, metropolitan area network, and wireless network; and

(d) the communication network switches protocol data units having a content selected from the group consisting of voice, video, and data.

8. A physical switching device for use in a communication network to switch Open Systems Interconnection (OSI) network layer protocol data units within the communication network on a shared communication medium, the physical switching device comprising:

(a) at least a first and a second virtual switch, each virtual switch comprising decision means for determining an associated directive based on a destination identifier within a particular protocol data unit received at a data port, each virtual switch further comprising processing means for inserting the particular protocol data unit into an outgoing data stream on another data port according to the associated directive to enable delivery of the protocol data unit to the destination identifier, both data ports being associated with a set of data interfaces selected from a plurality of data interfaces in a physical communication network switch, the set of data interfaces being assigned exclusively to a unique virtual switch;

(b) virtual link management means, operatively coupled to at least the first and the second virtual switches, for maintaining information on at least one virtual link between at least the first and the second virtual switch, each virtual link comprising a first end and a second end of a data path on the shared communication medium, each virtual link end comprising a data port from the plurality of data interfaces in the physical communication network switch.

9. The physical switching device of claim 8 wherein the first and the second virtual link end of the at least one virtual link are in a different set of data ports assigned exclusively to the first and the second virtual switch, respectively, such that the virtual link provides a data path between the first and the second virtual switch on the shared communication medium.

10. The physical switching device of claim 9 wherein the first and the second virtual switches are located in a single geographic location and the shared communication medium comprises a memory shared between the first and the second virtual switches.

11. The physical switching device of claim 8 wherein the first and the second virtual switches are geographically remote from one another and wherein the first and the second virtual link ends are in a single set of data ports assigned exclusively to the first and the second virtual switch such that the virtual link provides a data path between the first and the second virtual switches on the shared communication medium across a geographic distance.

12. The physical switching device of claim 11 wherein the shared communication medium comprises a high data transfer rate link between the first and the second virtual switches which spans the geographic distance.

13. The physical switching device of claim 8 further comprising at least one filter operatively coupled to the data path which filters protocol data units communicated in the virtual link data path according to one access policy out of a plurality of access policies that are separately specified for each virtual switch.

14. The physical switching device of claim 13 wherein the at least one filter comprises a first and a second filter operatively coupled to the first and the second virtual switch, respectively, which filters protocol data units communicated in the virtual link data path according to an access policy specified for the first and the second virtual switch, respectively.

15. The physical switching device of claim 8 wherein each data port is selected from the group consisting of protocol data units arriving on a data interface having unique attributes, a data interface on the physical switch, a time slot out of several time slots in a time-divided frame received at a data interface on the physical switch, and a code divided cell out of several code divided cells received on at least one data interface on the physical switch.

16. The physical switching device of claim 8 wherein the set of data interfaces associated with a virtual switch includes a first data interface including means for manipulating a protocol data unit having a different protocol type from a second data interface such that protocol data units of different protocol types can be switched within a single virtual switch, the different protocol data unit protocol types being selected from the group consisting of different Open Systems Interconnection (OSI) physical layer media types, different OSI link layer signaling protocols, and different OSI network layer protocols.

17. The physical switching device of claim 8 wherein each virtual switch processing means comprises means for restructuring the particular protocol data unit by deleting, inserting, and replacing bits in the particular protocol data unit in accordance with the associated directive prior to inserting the particular protocol data unit into the outgoing data stream.

18. The physical switching device of claim 8 wherein each virtual switch processing means comprises means for monitoring the particular protocol data unit by dropping, sending, sending a copy of, and auditing the contents of the particular protocol data unit in accordance with the associated directive prior to inserting the particular protocol data unit into the outgoing data stream.

19. The physical switching device of claim 8 wherein:

(a) the physical switching device further comprises means for performing operations selected from the group consisting of bridge, route, switch, in-line filter, protocol conversion, and a security function;

(b) the protocol data unit is selected from the group consisting of a frame, a cell, and a packet;

(c) the communication network is selected from the group consisting of local area network, wide area network, metropolitan area network, and wireless network; and

(d) the communication network switches protocol data units having a content selected from the group consisting of voice, video, and data.

20. A communication system which delivers Open Systems Interconnection (OSI) network layer protocol data units within a first and a second virtual closed user group on a shared communication medium, the communication system comprising:

(a) first virtual closed user group processing means for examining and modifying data bits within a protocol data unit received from a member of the first virtual closed user group on the shared communication medium, each member of the first virtual closed user group having a unique destination identifier, the first virtual closed user group processing means comprising delivery means for delivering the modified protocol data unit to another member of the first virtual closed user group;

(b) second virtual closed user group processing means for examining and modifying data bits within a protocol data unit received from a member of the second virtual closed user group on the shared communication medium, each member of the second virtual closed user group having a unique destination identifier, the second virtual closed user group processing means comprising delivery means for delivering the modified protocol data unit to another member of the second virtual closed user group; and

(c) a framer means, operatively coupled to the first and the second virtual closed user group processing means, for maintaining a database of all destination identifiers representing users in that user group currently reachable for delivery of protocol data units within the communication system, the framer means comprising means for requiring verification that each destination identifier in a protocol data unit indicates a user in that user group can be currently reached for delivery through a lookup in the database prior to completing delivery of the protocol data unit to the user indicated by the associated destination identifier, the framer means further comprising means for limiting access to the database such that each virtual closed user group only has access to specific destination identifiers owned by that particular virtual closed user group so that a protocol data unit having a destination identifier which is not owned by the particular virtual closed user group will not be delivered.

21. The communication system of claim 20 wherein each virtual closed user group processing means comprises means for modifying data bits within a received protocol data unit by deleting, inserting, and replacing bits in the received protocol data unit prior to delivering the modified protocol data unit to another member of the same virtual closed user group.

22. The communication system of claim 20 wherein each virtual closed user group processing means further comprises means for monitoring the received protocol data unit by dropping, sending, sending a copy of, and auditing the contents of the received protocol data unit prior to delivering the modified protocol data unit to another member of the same virtual closed user group.

23. The communication system of claim 20 wherein each virtual closed user group processing means delivers the modified protocol data unit to another member of the same virtual closed user group without modifying predetermined Open Systems Interconnection (OSI) physical layer, link layer, and network layer access protocols used to communicate protocol data units over the shared communication medium.

24. The communication system of claim 23 wherein each virtual closed user group processing means delivers the modified protocol data unit to another member of the same virtual closed user group without modifying the predetermined access protocols such that any particular device capable of communicating on the shared communication medium can be a member of either virtual closed user group by having the framer means limit database access to destination identifiers associated with the particular device to a particular desired virtual closed user group.

25. The communication system of claim 20 wherein the framer means further comprises means for assigning incoming protocol data unit traffic to each virtual closed user group based on an access policy that is separately specified in each virtual closed user group.

26. The communication system of claim 20 wherein the first and the second virtual closed user group processing means include a first and a second virtual switch, respectively, each virtual switch comprising decision means for determining an associated directive based on a destination identifier within a particular protocol data unit received at a data port, each virtual switch further comprising a processor, which performs the functions of the virtual closed user group delivery means by inserting the particular protocol data unit into an outgoing data stream on another data port according to the associated directive to enable delivery of the protocol data unit to the destination identifier within the protocol data unit.

27. The communication system of claim 26 wherein the first and the second virtual switch are located within a single physical switching device, both data ports for each virtual switch being associated with a set of data interfaces in the physical switching device assigned exclusively to the same virtual switch.

28. The communication system of claim 26 wherein the first and the second virtual switch are located within different physical switching devices, both data ports for each virtual switch being associated with a set of data interfaces in the respective physical switching devices which are assigned exclusively to the same virtual switch.

29. The communication system of claim 28 wherein the different physical switching devices are geographically remote from one another.

30. The communication system of claim 26 wherein each data port is selected from the group consisting of protocol data units arriving on a data interface having unique attributes, a data interface on a physical switching device, a time slot out of several time slots in a time-divided frame received at a data interface on a physical switching device, and a code divided cell out of several code divided cells received on at least one data interface on a physical switching device.

31. The communication system of claim 26 wherein the set of data interfaces associated with a virtual switch from a physical switching device includes a first data interface including means for manipulating a protocol data unit having a different protocol type from a second data interface such that protocol data units of different protocol types can be switched within a single virtual switch, the different protocol data unit protocol types being selected from the group consisting of different Open Systems Interconnection (OSI) physical layer media types, different OSI link layer signaling protocols, and different OSI network layer protocols.

32. The communication system of claim 26 wherein each virtual switch processor comprises means for restructuring the particular protocol data unit by deleting, inserting, and replacing bits in the particular protocol data unit in accordance with the associated directive prior to inserting the particular protocol data unit into the outgoing data stream.

33. The communication system of claim 26 wherein each virtual switch processor comprises means for monitoring the particular protocol data unit by dropping, sending, sending a copy of, and auditing the contents of the particular protocol data unit in accordance with the associated directive prior to inserting the particular protocol data unit into the outgoing data stream.

34. The communication system of claim 26 wherein:

(a) the protocol data unit is selected from the group consisting of a frame, a cell, and a packet;

(b) the communication network is selected from the group consisting of local area network, wide area network, metropolitan area network, and wireless network; and

(c) the communication network switches protocol data units having a content selected from the group consisting of voice, video, and data.

35. The communication system of claim 26 further comprising a virtual link between the first and the second virtual switch, the virtual link comprising a first end and a second end of a data path on the shared communication medium, each end comprising a data port in a different virtual closed user group.

36. The communication system of claim 35 further comprising a filter operatively coupled to the data path which filters protocol data units communicated in the data path.

37. The communication system of claim 20 wherein the first virtual closed user group processing means include a first and a second virtual switch, respectively, each virtual switch comprising decision means for determining an associated directive based on a destination identifier within a particular protocol data unit received at a data port, each virtual switch further comprising a processor, which performs the functions of the virtual closed user group delivery means by inserting the particular protocol data unit into an outgoing data stream on another data port according to the associated directive to enable delivery of the protocol data unit to the destination identifier within the protocol data unit.

38. The communication system of claim 37 wherein the first and the second virtual switch are located within a single physical switching device, both data ports for each virtual switch being associated with a set of data interfaces in the physical switching device assigned exclusively to the same virtual switch.

39. The communication system of claim 37 wherein the first and the second virtual switch are located within different physical switching devices, both data ports for each virtual switch being associated with a set of data interfaces in the respective physical switching devices which are assigned exclusively to the same virtual switch.

40. The communication system of claim 37 wherein the different physical switching devices are geographically remote from one another.

41. The communication system of claim 37 wherein each data port is selected from the group consisting of protocol data units arriving on a data interface having unique attributes, a data interface on a physical switching device, a time slot out of several time slots in a time-divided frame received at a data interface on a physical switching device, and a code divided cell out of several code divided cells received on at least one data interface on a physical switching device.

42. The communication system of claim 37 wherein the set of data interfaces associated with a virtual switch from a physical switching device includes a first data interface including means for manipulating a protocol data unit having a different protocol type from a second data interface such that protocol data units of different protocol types can be switched within a single virtual switch, the different protocol data unit protocol types being selected from the group consisting of different Open Systems Interconnection (OSI) physical layer media types, different OSI link layer signaling protocols, and different OSI network layer protocols.

43. The communication system of claim 37 wherein each virtual switch processor comprises means for restructuring the particular protocol data unit by deleting, inserting, and replacing bits in the particular protocol data unit in accordance with the associated directive prior to inserting the particular protocol data unit into the outgoing data stream.

44. The communication system of claim 37 wherein each virtual switch processor comprises means for monitoring the particular protocol data unit by dropping, sending, sending a copy of, and auditing the contents of the particular protocol data unit in accordance with the associated directive prior to inserting the particular protocol data unit into the outgoing data stream.

45. The communication system of claim 37 wherein:

(a) the protocol data unit is selected from the group consisting of a frame, a cell, and a packet;

(b) the communication network is selected from the group consisting of local area network, wide area network, metropolitan area network, and wireless network; and

(c) the communication network switches protocol data units having a content selected from the group consisting of voice, video, and data.

46. The communication system of claim 37 further comprising a virtual link between the first and the second virtual switch, the virtual link comprising a first end and a second end of a data path on the shared communication medium, each end comprising a data port in the same virtual closed user group.

47. The communication system of claim 46 further comprising a filter operatively coupled to the data path which filters protocol data units communicated in the data path.

48. A method for delivering Open Systems Interconnection (OSI) network layer protocol data units within a first and a second virtual closed user group on a shared communication medium in a communication system, the method comprising the device-implemented steps of:

(a) examining and modifying data bits within a protocol data unit received from a member of the first virtual closed user group on the shared communication medium, each member of the first virtual closed user group having a unique destination identifier;

(b) examining and modifying data bits within a protocol data unit received from a member of the second virtual closed user group on the shared communication medium, each member of the second virtual closed user group having a unique destination identifier;

(c) maintaining a database of all destination identifiers representing members which are currently reachable for delivery of protocol data units within the communication system;

(d) limiting access to the database such that each virtual closed user group only has access to specific destination identifiers owned by that particular virtual closed user group;

(e) requiring verification that each destination identifier in a protocol data unit indicates a member which is currently reachable for delivery through a lookup in the database prior to completing delivery of the protocol data unit to the member represented by the associated destination identifier;

(f) delivering the first virtual closed user group modified protocol data unit to another member of the first virtual closed user group after verifying that the first virtual closed user group member destination identifier is currently reachable; and

(g) delivering the second virtual closed user group modified protocol data unit to another member of the second virtual closed user group after verifying that the second virtual closed user group member destination identifier is currently reachable, step (f) and (g) being device-implemented such that a protocol data unit having a destination identifier which is not owned by the particular virtual closed user group will not be delivered.

49. The method of claim 48 wherein each examining and modifying step comprises modifying data bits within a received protocol data unit by deleting, inserting, and replacing bits in the received protocol data unit prior to delivering the modified protocol data unit to another member of the same virtual closed user group.

50. The method of claim 48 wherein each examining and modifying step comprises monitoring the received protocol data unit by dropping, sending, sending a copy of, and auditing the contents of the received protocol data unit prior to delivering the modified protocol data unit to another member of the same virtual closed user group.

51. The method of claim 48 wherein steps (a) through (g) are performed such that all predetermined physical layer, link layer, and network layer access protocols used to communicate protocol data units over the shared communication medium are preserved.

52. The method of claim 51 wherein steps (a) through (g) are performed such that all of the predetermined access protocols are preserved so that any particular device capable of communicating on the shared communication medium can be a member of either virtual closed user group by performing an additional step of adding a destination identifier associated with the particular device to the database.

53. The method of claim 48 further comprising a step of assigning incoming protocol data unit to each virtual closed user group based on an access policy that is separately specified in each virtual closed user group.

54. The method of claim 48 further comprising a step of providing a virtual link between the first and the second virtual closed user group, the virtual link comprising a first end and a second end of a data path on the shared communication medium, each end comprising a data port in a different virtual closed user group.

55. The method of claim 54 wherein the providing step comprises utilizing a shared memory as the shared communication medium to provide the virtual link.

56. The method of claim 54 wherein the providing step comprises utilizing a high data transfer rate link which spans a geographic distance between the first and the second virtual closed user group to provide the virtual link.

57. The method of claim 55 further comprising a step of filtering protocol data units communicated in the virtual link data path according to an access policy.

* * * * *

US005838907A

United States Patent [19]
Hansen

[11] **Patent Number: 5,838,907**
[45] **Date of Patent: Nov. 17, 1998**

[54] **CONFIGURATION MANAGER FOR NETWORK DEVICES AND AN ASSOCIATED METHOD FOR PROVIDING CONFIGURATION INFORMATION THERETO**

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[73] Assignee: **Compaq Computer Corporation**, Houston, Tex.

[21] Appl. No.: **603,062**

[22] Filed: **Feb. 20, 1996**

[51] **Int. Cl.**[6] **G06F 9/00**
[52] **U.S. Cl.** **395/200.5**; 395/200.51; 395/200.53; 395/200.54; 395/200.55
[58] **Field of Search** 395/200.5, 200.51, 395/500.47, 200.81, 200.82, 200.53, 200.54, 200.55

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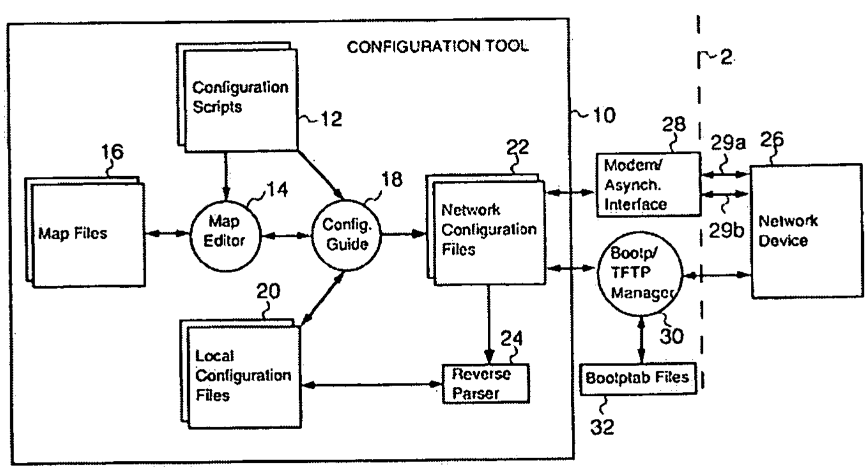
Primary Examiner—Alyssa H. Bowler
Assistant Examiner—Dzung Nguyen
Attorney, Agent, or Firm—Beyer & Weaver, LLP

[57] **ABSTRACT**

A configuration manager for configuring a network device remotely coupled thereto and an associated computer-implemented method for configuring the network device. The configuration manager includes a configuration script stored in a memory subsystem of a computer system and first and second software modules respectively executable by a processor subsystem of the computer system. The configuration script contains a series of executable instructions for constructing a configuration file and a bootptab file for a first specified type of network device. By executing the instructions contained in the configuration script, the first software module may construct a configuration file suitable for upload to a network device and a bootptab file suitable for identifying the network device. Configuration requests issued by the network device are processed by the second software module by identifying the requesting network device using the constructed bootptab file and configuring the requesting network device by uploading the constructed configuration file thereto.

18 Claims, 12 Drawing Sheets



256

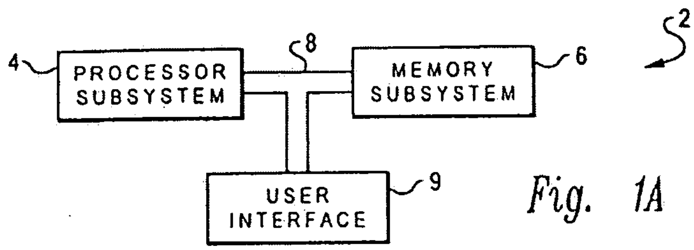


Fig. 1A

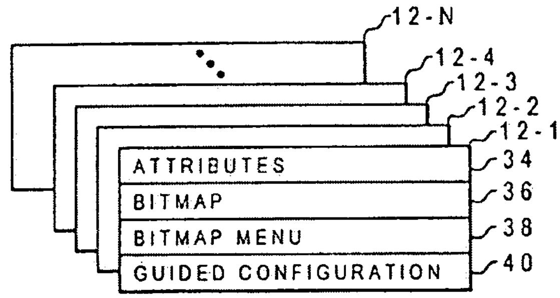


Fig. 2A

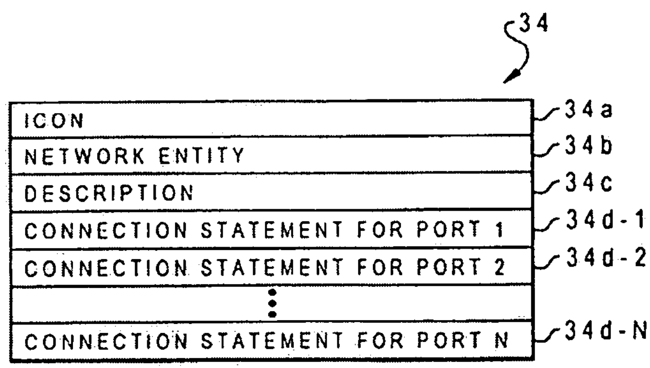
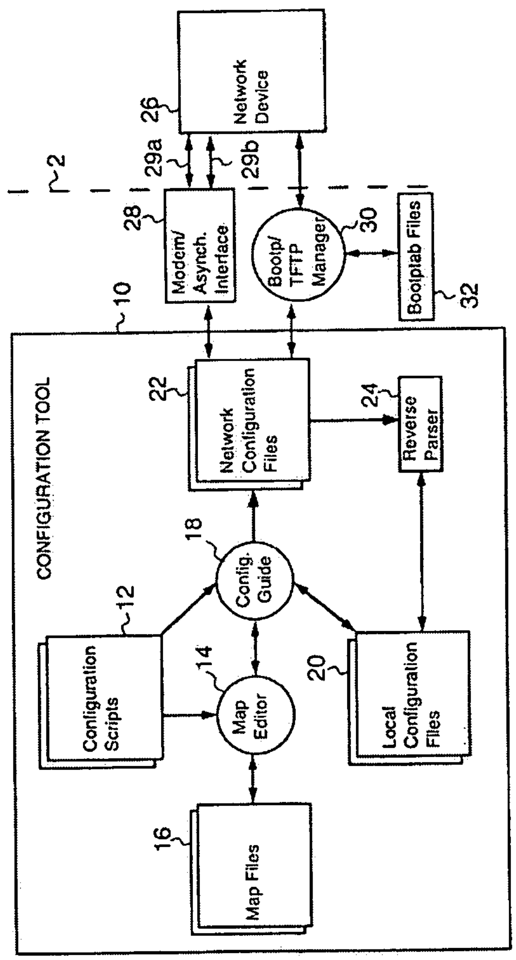


Fig. 2B



Network Device
26
29a
29b
2
28
Modem/ Asynch. Interface
Bootp/ TFTP Manager
30
Bootptab Files
32
10
CONFIGURATION TOOL
22
Network Configuration Files
24
Reverse Parser
18
Config. Guide
12
Configuration Scripts
14
Map Editor
20
Local Configuration Files
16
Map Files

Fig. 1B

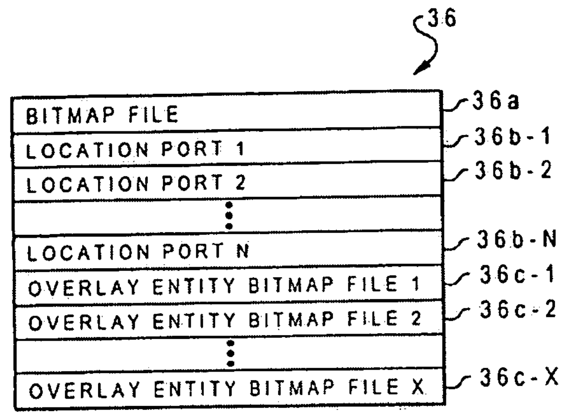


Fig. 2C

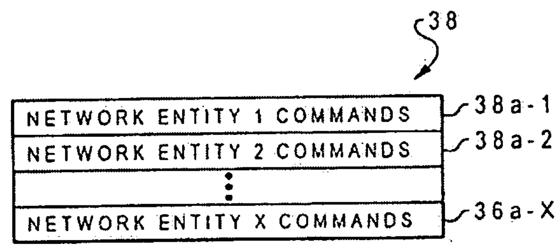


Fig. 2D

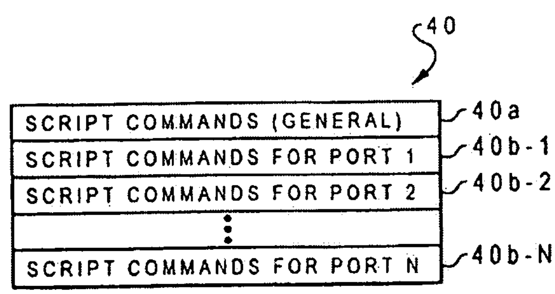


Fig. 2E

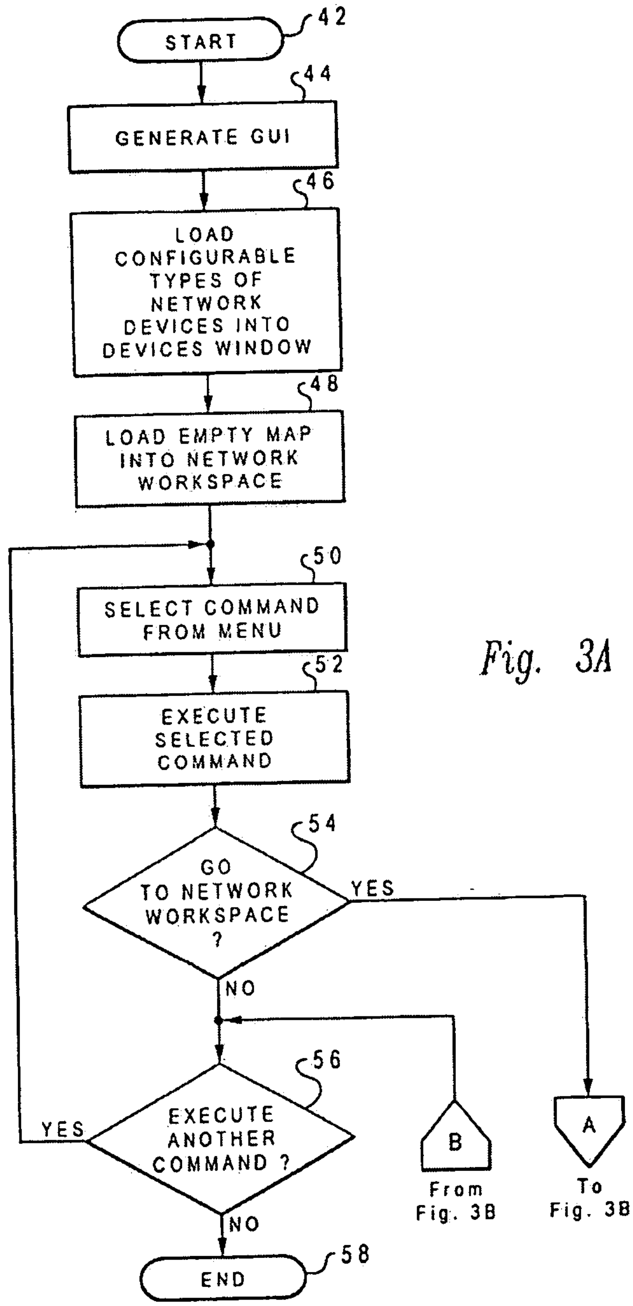

START
42
GENERATE GUI
44
LOAD CONFIGURABLE TYPES OF NETWORK DEVICES INTO DEVICES WINDOW
46
LOAD EMPTY MAP INTO NETWORK WORKSPACE
48
SELECT COMMAND FROM MENU
50
EXECUTE SELECTED COMMAND
52
GO TO NETWORK WORKSPACE ?
54
YES
NO
EXECUTE ANOTHER COMMAND ?
56
YES
NO
END
58
B
From Fig. 3B
A
To Fig. 3B

Fig. 3A

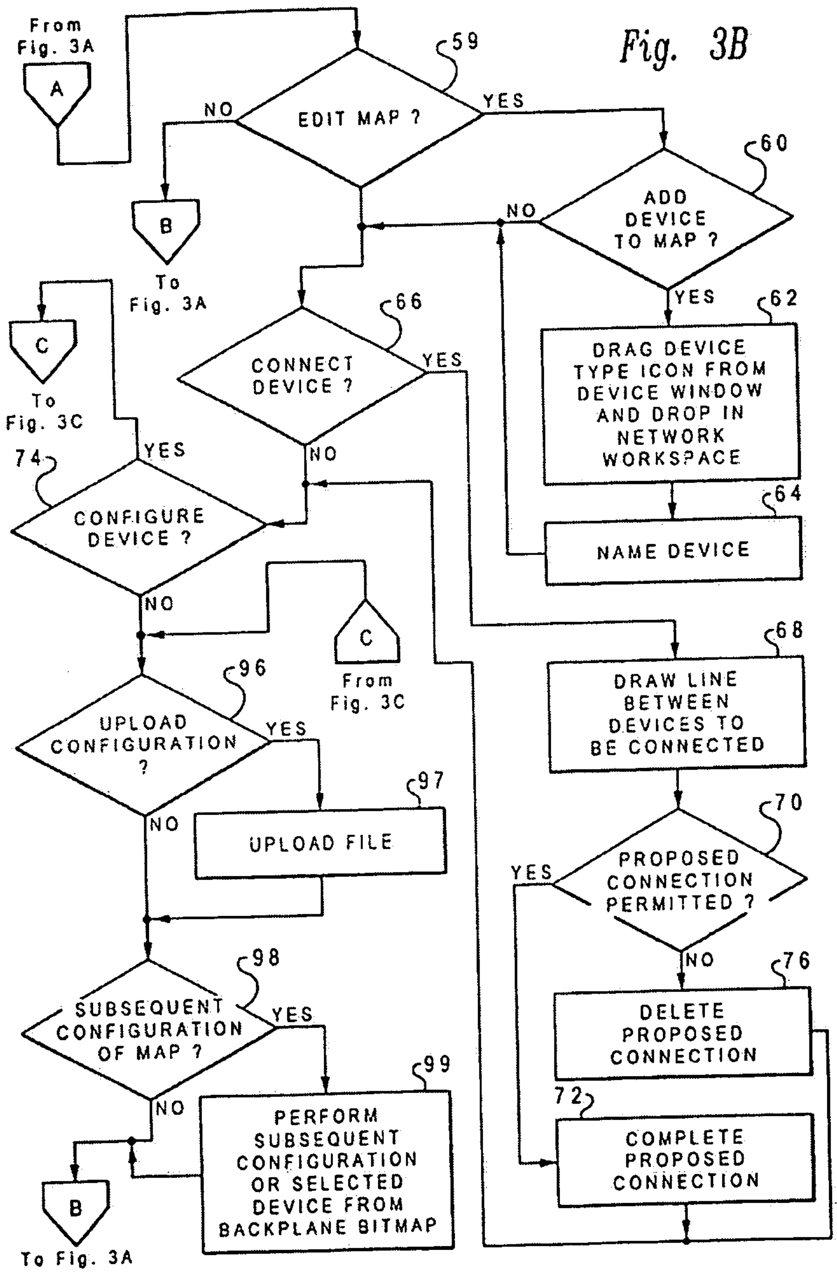

From Fig. 3A
A
59
EDIT MAP ?
NO
YES
B
To Fig. 3A
60
ADD DEVICE TO MAP ?
NO
YES
62
DRAG DEVICE TYPE ICON FROM DEVICE WINDOW AND DROP IN NETWORK WORKSPACE
64
NAME DEVICE
66
CONNECT DEVICE ?
YES
NO
C
To Fig. 3C
74
CONFIGURE DEVICE ?
YES
NO
C
From Fig. 3C
68
DRAW LINE BETWEEN DEVICES TO BE CONNECTED
70
PROPOSED CONNECTION PERMITTED ?
YES
NO
76
DELETE PROPOSED CONNECTION
72
COMPLETE PROPOSED CONNECTION
96
UPLOAD CONFIGURATION ?
YES
NO
97
UPLOAD FILE
98
SUBSEQUENT CONFIGURATION OF MAP ?
YES
NO
99
PERFORM SUBSEQUENT CONFIGURATION OR SELECTED DEVICE FROM BACKPLANE BITMAP
B
To Fig. 3A

Fig. 3B

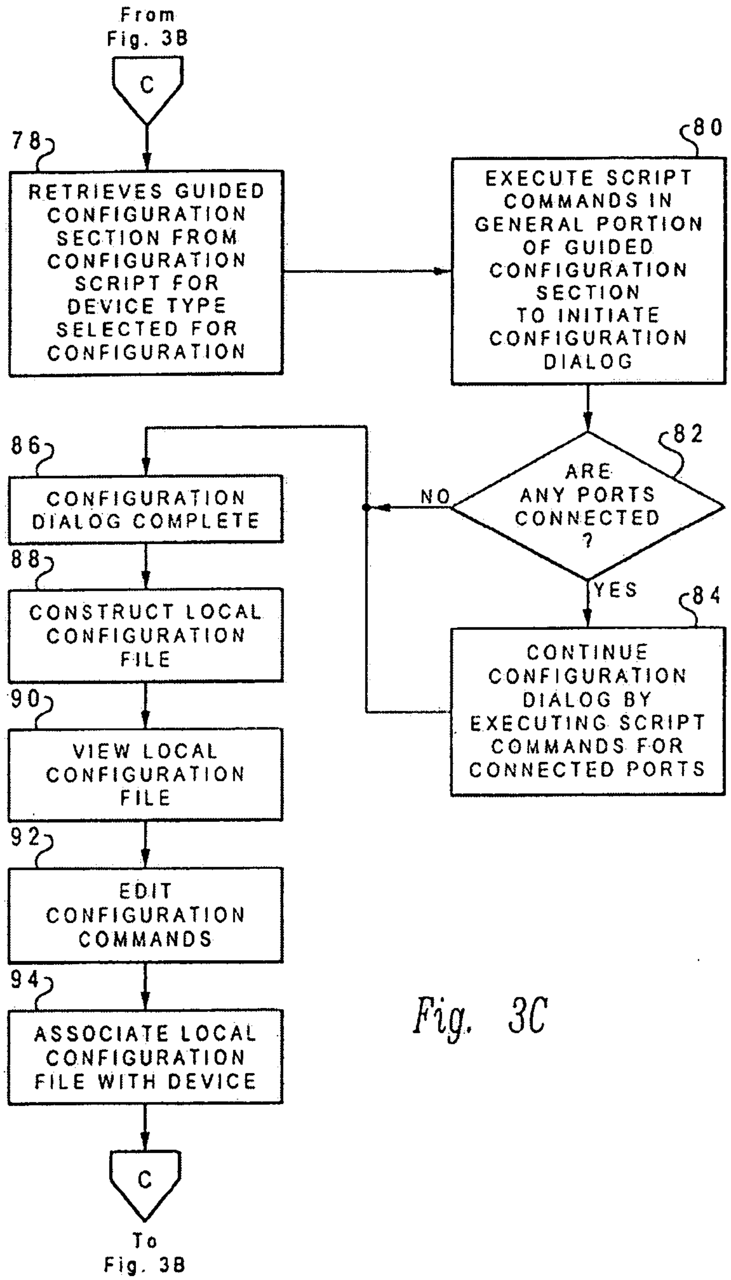

From
Fig. 3B
C
78
RETRIEVES GUIDED CONFIGURATION SECTION FROM CONFIGURATION SCRIPT FOR DEVICE TYPE SELECTED FOR CONFIGURATION
80
EXECUTE SCRIPT COMMANDS IN GENERAL PORTION OF GUIDED CONFIGURATION SECTION TO INITIATE CONFIGURATION DIALOG
82
ARE ANY PORTS CONNECTED ?
NO
YES
84
CONTINUE CONFIGURATION DIALOG BY EXECUTING SCRIPT COMMANDS FOR CONNECTED PORTS
86
CONFIGURATION DIALOG COMPLETE
88
CONSTRUCT LOCAL CONFIGURATION FILE
90
VIEW LOCAL CONFIGURATION FILE
92
EDIT CONFIGURATION COMMANDS
94
ASSOCIATE LOCAL CONFIGURATION FILE WITH DEVICE
C
To
Fig. 3B

Fig. 3C

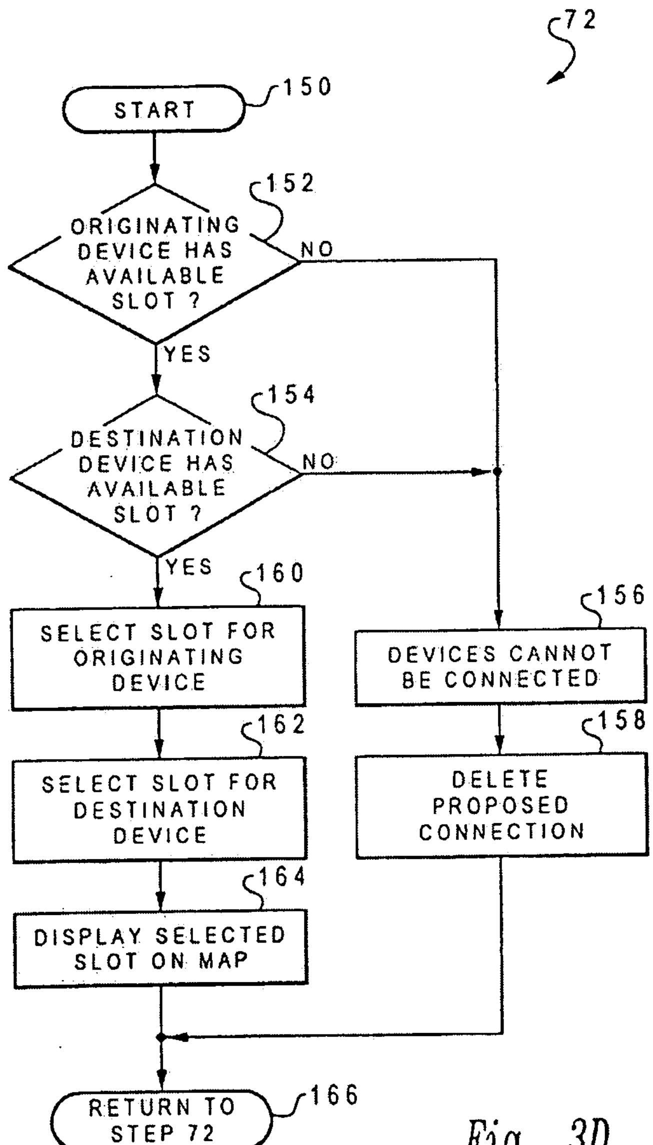

72
START
150
ORIGINATING DEVICE HAS AVAILABLE SLOT ?
152
NO
YES
DESTINATION DEVICE HAS AVAILABLE SLOT ?
154
NO
YES
SELECT SLOT FOR ORIGINATING DEVICE
160
SELECT SLOT FOR DESTINATION DEVICE
162
DISPLAY SELECTED SLOT ON MAP
164
DEVICES CANNOT BE CONNECTED
156
DELETE PROPOSED CONNECTION
158
RETURN TO STEP 72
166

Fig. 3D

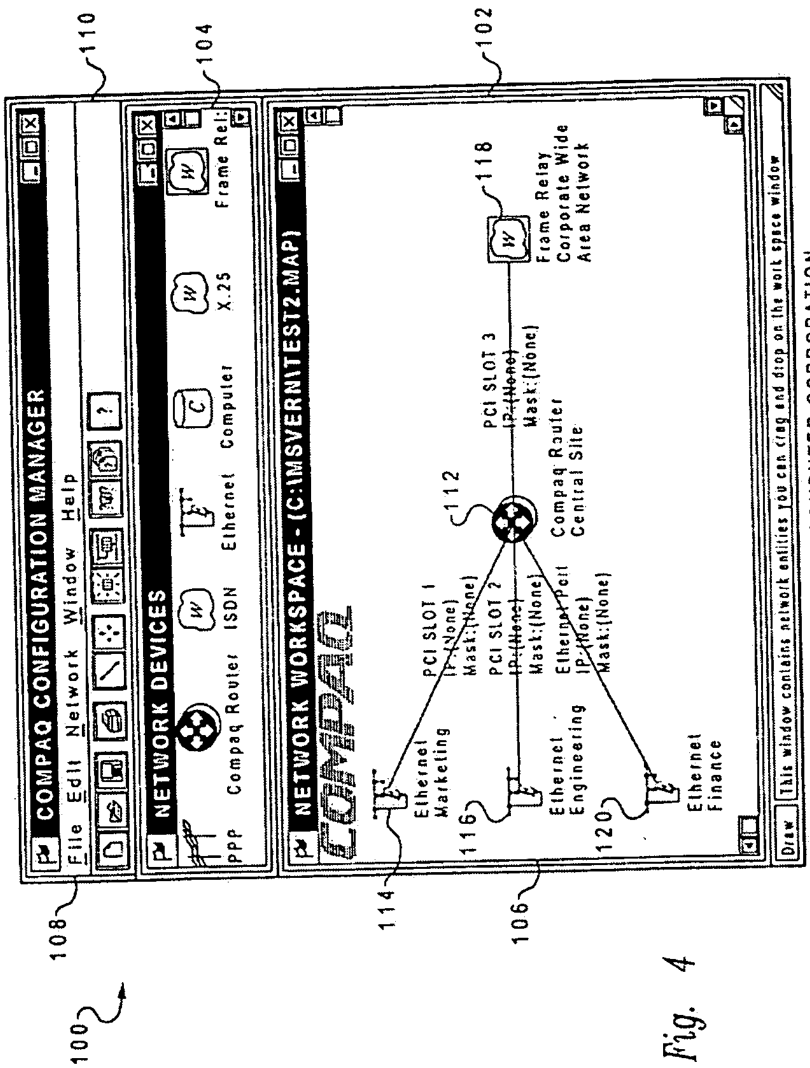

COMPAQ CONFIGURATION MANAGER
File Edit Network Window Help
NETWORK DEVICES
PPP Compaq Router ISDN Ethernet Computer X.25 Frame Rel
NETWORK WORKSPACE - (C:\MSVERNITEST2.MAP)
Ethernet Marketing
Ethernet Engineering
Ethernet Finance
PCI SLOT 1 IP:(None) Mask:(None)
PCI SLOT 2 IP:(None) Mask:(None)
Ethernet Port IP:(None) Mask:(None)
Compaq Router Central Site
PCI SLOT 3 IP:(None) Mask:(None)
Frame Relay Corporate Wide Area Network
Draw
This window contains network entities you can drag and drop on the work space window
© 1995 COMPAQ COMPUTER CORPORATION
100
102
104
106
108
110
112
114
116
118
120

Fig. 4

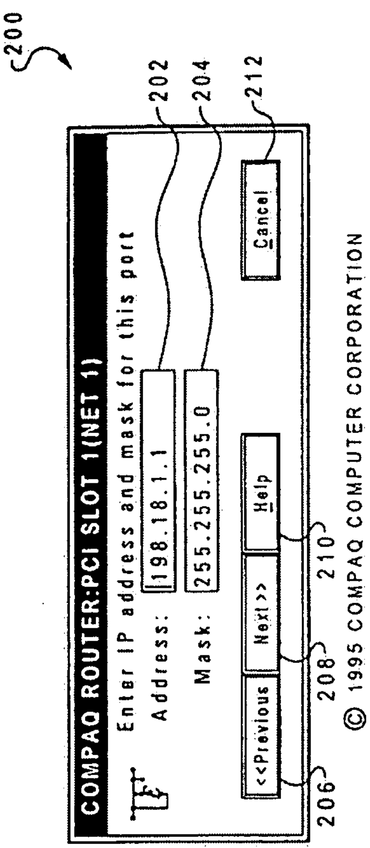

200
202
204
212
COMPAQ ROUTER:PCI SLOT 1(NET 1)
Enter IP address and mask for this port
Address:
198.18.1.1
Mask:
255.255.255.0
<<Previous
Next>>
Help
Cancel
206
208
210
© 1995 COMPAQ COMPUTER CORPORATION

Fig. 5

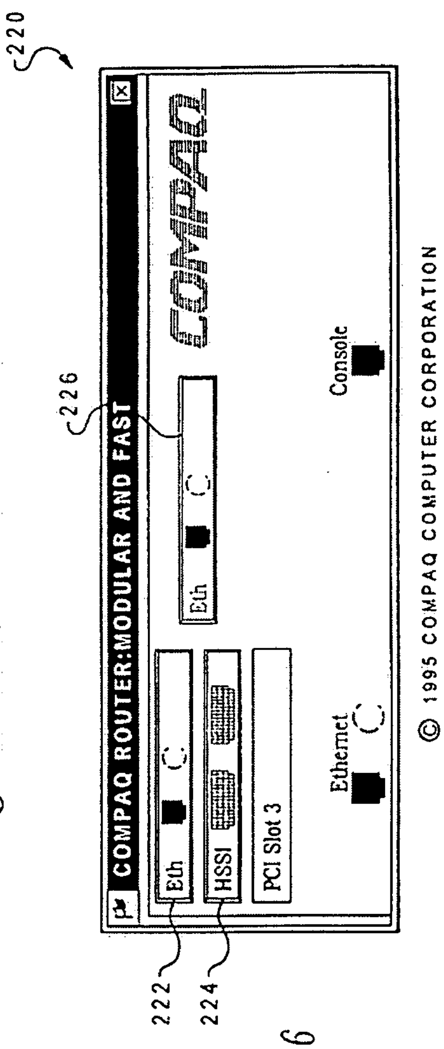

220
226
COMPAQ ROUTER:MODULAR AND FAST
Eth
HSSI
PCI Slot 3
Eth
Ethernet
Console
COMPAQ
222
224
© 1995 COMPAQ COMPUTER CORPORATION

Fig. 6

100

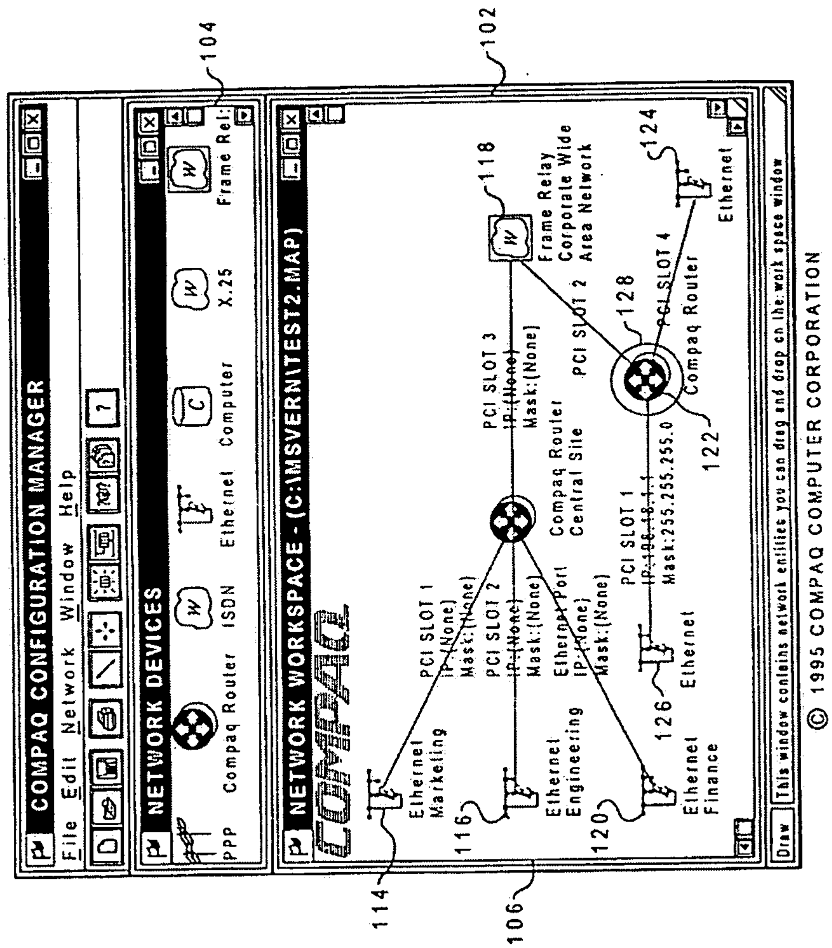

COMPAQ CONFIGURATION MANAGER
File Edit Network Window Help
NETWORK DEVICES
PPP
Compaq Router
ISDN
Ethernet
Computer
X.25
Frame Rel
NETWORK WORKSPACE - (C:\MSVERNITEST2.MAP)
COMPAQ
Ethernet Marketing
Ethernet Engineering
Ethernet Finance
PCI SLOT 1 IP:(None) Mask:(None)
PCI SLOT 2 IP:(None) Mask:(None)
Ethernet Port IP:(None) Mask:(None)
PCI SLOT 3 IP:(None) Mask:(None)
Compaq Router Central Site
PCI SLOT 1 IP:198.18.1.1 Mask:255.255.255.0
Ethernet
PCI SLOT 2
Compaq Router
PCI SLOT 4
Frame Relay Corporate Wide Area Network
Ethernet
Draw
This window contains network entities you can drag and drop on the work space window
© 1995 COMPAQ COMPUTER CORPORATION
102
104
106
114
116
118
120
122
124
126
128

Fig. 7

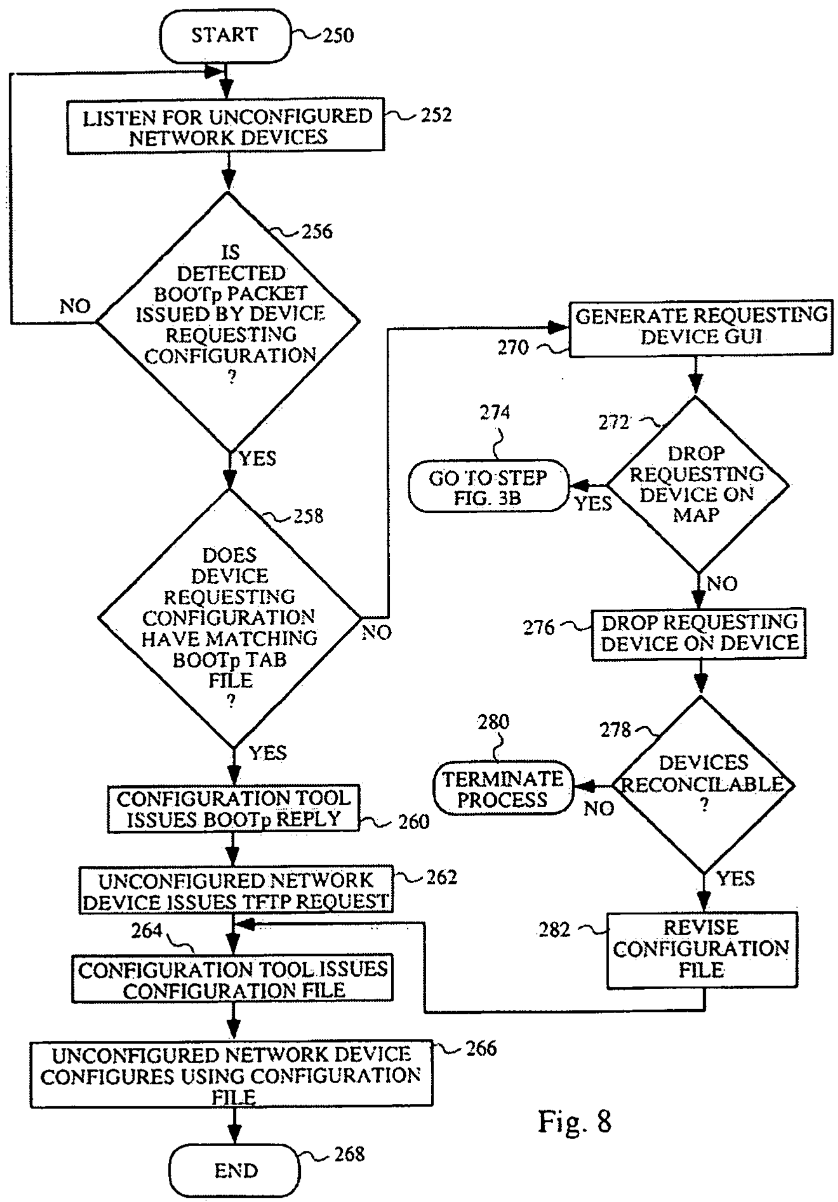
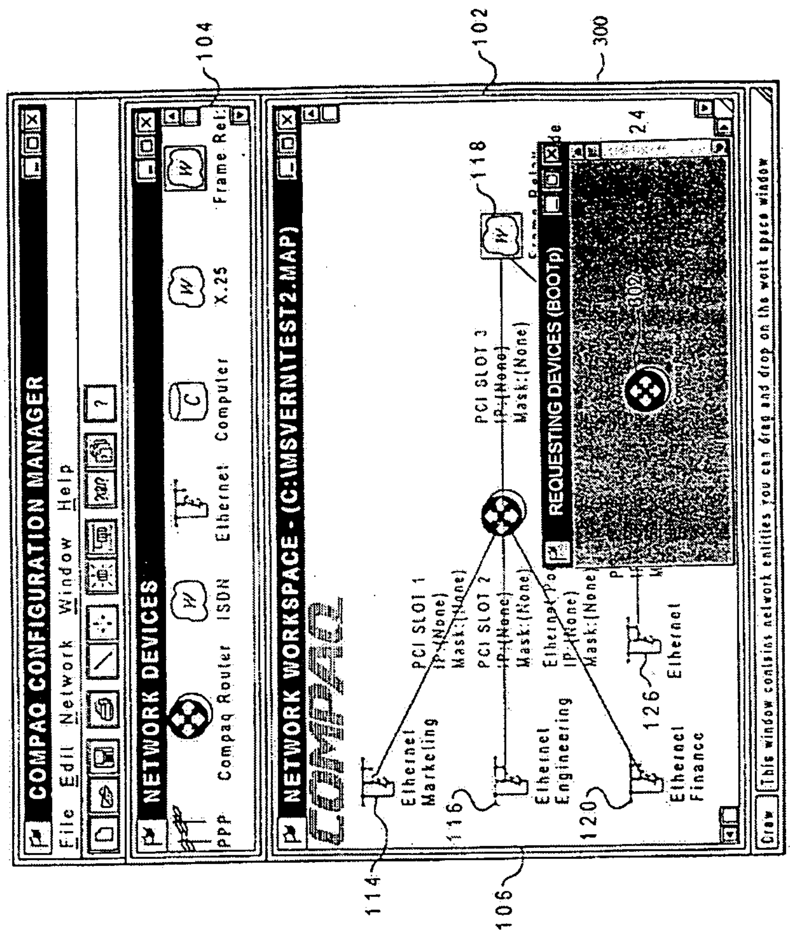

START
250
LISTEN FOR UNCONFIGURED NETWORK DEVICES
252
IS DETECTED BOOTp PACKET ISSUED BY DEVICE REQUESTING CONFIGURATION ?
256
NO
YES
DOES DEVICE REQUESTING CONFIGURATION HAVE MATCHING BOOTp TAB FILE ?
258
NO
YES
CONFIGURATION TOOL ISSUES BOOTp REPLY
260
UNCONFIGURED NETWORK DEVICE ISSUES TFTP REQUEST
262
264
CONFIGURATION TOOL ISSUES CONFIGURATION FILE
UNCONFIGURED NETWORK DEVICE CONFIGURES USING CONFIGURATION FILE
266
END
268
GENERATE REQUESTING DEVICE GUI
270
274
272
GO TO STEP FIG. 3B
YES
DROP REQUESTING DEVICE ON MAP
NO
276
DROP REQUESTING DEVICE ON DEVICE
280
278
TERMINATE PROCESS
NO
DEVICES RECONCILABLE ?
YES
282
REVISE CONFIGURATION FILE

Fig. 8


COMPAQ CONFIGURATION MANAGER
File Edit Network Window Help
NETWORK DEVICES
PPP
Compaq Router
ISDN
Ethernet
Computer
X.25
Frame Rel
NETWORK WORKSPACE - (C:\MSVERNITEST2.MAP)
COMPAQ
Ethernet Marketing
Ethernet Engineering
Ethernet Finance
PCI SLOT 1
IP:(None)
Mask:(None)
PCI SLOT 2
IP:(None)
Mask:(None)
PCI SLOT 3
IP:(None)
Mask:(None)
Ethernet
REQUESTING DEVICES (BOOTp)
This window contains network entities you can drag and drop on the work space window
© 1995 COMPAQ COMPUTER CORPORATION
104
102
300
118
114
116
120
126
106
24
302

100

Fig. 9

CONFIGURATION MANAGER FOR NETWORK DEVICES AND AN ASSOCIATED METHOD FOR PROVIDING CONFIGURATION INFORMATION THERETO

CROSS REFERENCE TO RELATED APPLICATION

This application is related to co-pending U.S. patent application Ser. No. 08/603,061, filed on even date herewith, entitled METHOD AND APPARATUS FOR GUIDED CONFIGURATION OF UNCONFIGURED NETWORK AND INTERNETWORK DEVICES", assigned to the Assignee of the present application and hereby incorporated by reference as if reproduced in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This application generally relates to computer networks and internetworks and, more particularly, to a configuration manager which, from a central location, provides configuration information to remote devices included in a computer network or internetwork.

2. Description of Related Art

Generally speaking, a network is a collection of user devices, generally classified as data terminal equipment (or "DTE"), interconnected for bi-directional exchanges of information. For example, visual displays, computer systems and office workstations are all electronic devices classified as DTEs. A local area network (or "LAN") is an interconnection of plural computer systems distributed around a single site. A wide area network (or "WAN") is an interconnection of plural computer systems located at different sites. Traditionally, computer systems have used modems to connect to a WAN via the public switched telephone network (or "PSTN") or public switched data network (or "PSDN"). In recent years, WANs which utilize integrated services digital networks (or "ISDNs"), which enable data to be transmitted without modems, to interconnect computer systems have become more common. Finally, an internetwork is a collection of networks interconnected by a WAN.

Devices are initially unconfigured when delivered by the factory. Configuration is a process during which the hardware and software of an unconfigured device is organized and interconnected so that the configured device will be able to perform the tasks desired thereof. As is well appreciated in the art, the wide variety of devices which may be installed on a network, as well as the variety of networks which may be connected to form an internetwork, makes the configuration of networks and internetworks a difficult task which requires highly detailed technical knowledge of the various networks, the protocols used to link with the various networks and the devices to be installed thereon. Thus, configuration of network devices is often one of the most daunting tasks facing a network administrator, particularly for those in charge of small and medium size networks have between 100 and 1,000 nodes. While such networks are relatively complex, their administrators often have only minimal training in internetworking administration and may be unfamiliar with routing technology and/or WAN technology.

For example, data link protocols are used to control access to networks. A LAN typically uses the logical link control (or "LLC") subclass of the high-level data link control (or "HDLC") protocol as its data link protocol. However, an X.25-type packet-switching WAN uses link access procedure, balanced (or "LAPB"), a protocol based on HDLC, as its data link protocol. The data link protocol for an ISDN-type WAN, on the other hand, may either be a connection-orientated protocol known as frame switching or a connectionless protocol known as frame relay.

Even when configuration information is available, further complications problems arise when transporting the configuration information to a network device. For example, in order to communicate with a remotely located network device, a network administrator needs to know where to send the information. However, that knowledge typically resides in the configuration information for the network device. Thus, the network administrator is constrained as to what information may be delivered to the network device until after the device is configured but, until the device is configured, much of the configuration information is undeliverable. While techniques for transporting information to an unconfigured device using a limited amount of configuration information exist, inconsistencies in such information often complicate the task of transferring information using such techniques.

Thus, it can be readily seen from the foregoing that it would be desirable to simplify the task of configuring a remotely located network device. It is, therefore, the object of this invention to provide a configuration manager and an associated method of configuring a remote network device from a central location.

SUMMARY OF THE INVENTION

In one embodiment, the present invention is of a configuration manager for configuring a network device remotely coupled thereto. The configuration manager includes a configuration script stored in a memory subsystem of a computer system and first and second software modules respectively executable by a processor subsystem of the computer system. The configuration script contains a series of executable instructions for constructing a configuration file and a bootptab file for a first specified type of network device. By executing the instructions contained in the configuration script, the first software module may construct a configuration file suitable for upload to a network device and a bootptab file suitable for identifying the network device. Configuration requests issued by the network device are processed by the second software module by identifying the requesting network device using the constructed bootptab file and configuring the requesting network device by uploading the constructed configuration file thereto.

In one aspect of this embodiment of the invention, the configuration script includes a first section which contains a series of configuration commands which generate requests for information such that information received by the first software module in response to the requests for information is used to construct the configuration and bootptab files. In another aspect of this embodiment of the invention, the configuration script includes a second section which contains a set of connection rules for connecting the first specified type of network device to at least one other specified type of network device.

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In a related aspect thereof, the second section of the configuration script includes a first portion which uniquely identifies the network device and a second portion which identifies devices installed in the network device. In another related aspect thereof, the first section of the configuration script includes a first portion which corresponds to each of the at least one other specified type of network device specified in the connection rules contained in the second section of the configuration script. Each such portion contains a subset of the series of configuration commands contained in the first section of the configuration script and each such subset of configuration commands are executed only if the network device for which the configuration file is being constructed is connected to a network device of the other specified type of network device.

In another embodiment, the present invention is of a computer-implemented method for configuring a remotely located network device. A request for configuration issued by a network device is detected. If a previously constructed configuration file corresponds to the network device issuing the request for configuration, a reply which identifies the configuration file is transmitted to the network device. The configuration file is then transmitted to the network device in response to a request for the identified configuration file. The configuration file is constructed using a configuration script containing a series of executable instructions for constructing a configuration file for a first specified type of network device is provided. The configuration file is then constructed by executing the series of instructions contained in the configuration script. In one aspect thereof, the configuration script includes a first section containing a series of configuration commands. Requests for information are issued by executing the series of configuration commands contained in the first section of the configuration script and information received in response to the requests for information is used to construct the configuration file. The information may also be used to construct a bootptab file which, in addition to the configuration file, contains a unique identifier for the network device.

In another aspect of this embodiment of the invention, a determination of whether the configuration file corresponds to the network device issuing the request for configuration is accomplished by determining if the network device issuing the request for configuration has an identification code which matches an identification code contained in the bootptab file and determining if devices installed in the network device issuing the request for configuration match the installed devices identified in the bootptab file.

In yet another aspect of this embodiment of the invention, the provided configuration script may also include a second section containing a set of connection rules for connecting the first specified type of network device to at least one other specified type of network device. Within the second section, a first portion corresponding to each of the at least one other specified type of network device specified in the connection rules contained in the second section of the configuration script may also be provided. Each first portion contains a subset of the series of configuration commands which are executed only if the network device for which the configuration file is being constructed is connected to a network device of the other specified type of network device.

BRIEF DESCRIPTION OF THE DRAWING

The present invention may be better understood, and its numerous objects, features and advantages will become apparent to those skilled in the art by reference to the accompanying drawing, in which:

FIG. 1A is a simplified block diagram of a computer system on which a network device configuration tool may be installed;

FIG. 1B is a block diagram of a network device configuration tool constructed in accordance with the teachings of the present invention;

FIG. 2A is a block diagram of a configuration scripts portion of the network device configuration tool of FIG. 1;

FIG. 2B is an expanded block diagram of an attributes section of a configuration script of FIG. 2A;

FIG. 2C is an expanded block diagram of a bitmap section of a configuration script of FIG. 2A;

FIG. 2D is an expanded block diagram of a bitmap menu section of a configuration script of FIG. 2A;

FIG. 2E is an expanded block diagram of a guided configuration section of a configuration script of FIG. 2A;

FIG. 3A is a flow chart of a method for guiding configuration of a network device in accordance with the teachings of the present invention;

FIG. 3B is a flow chart of a map edit section of the flow chart of FIG. 3A;

FIG. 3C is a flow chart of a guided configuration subsection of the flow chart of FIG. 3B;

FIG. 3D is a flow chart of a method for determining whether a pair of network devices are connectable;

FIG. 4 illustrates a configuration manager GUI for constructing a map of configured network devices with a preconstructed network configuration map in a network workspace portion thereof;

FIG. 5 illustrates an exemplary guided configuration GUI for constructing a configuration script for a network device;

FIG. 6 illustrates a backplane bitmap for a configured network device;

FIG. 7 illustrates the configuration manager GUI of FIG. 4 with a preconstructed network configuration map modified to include newly added and configured devices thereon;

FIG. 8 is a flowchart of a method of configuring a remote network device in accordance with another aspect of the present invention; and

FIG. 9 illustrates a pop-up bootP GUI in which an unconfigured network device is requesting configuration information.

DETAILED DESCRIPTION

Referring first to FIG. 1A, a computer system 2 suitable for installing a network device configuration tool thereon may now be seen. The computer system 2 is comprised of a processor subsystem 4, for example, a type P6 Pentium processor manufactured by Intel Corporation of Santa Clara, Calif., coupled to a memory subsystem 6, for example, a hard drive or other auxiliary memory device capable of storing large amounts of data infrequently used by the processor subsystem 4, by a system bus 8, preferably, a 32-bit wide peripheral connection interface (or "PCI") bus. Also coupled to the system bus 8 is a user interface 9. Commonly, the user interface is comprised of three peripheral devices—a video display, a keyboard and a pointing device.

Referring now to FIG. 1B, a network device configuration tool 10 constructed in accordance with the teachings of the present invention will now be described in greater detail. The network device configuration tool 10 is graphical user interface (or "GUI") based software launchable from a suitable platform installed on the computer system 2. For

example, Windows 95 and Windows NT 3.51, both manufactured by Microsoft of Redmond, Wash., are suitable platforms from which the network device configuration tool 10 may be launched.

In its broadest sense, the network device configuration tool 10 provides a GUI in which the so-called "drag and drop" process is used to construct a network configuration map comprised of a series of interconnected network devices and/or network entities, for example, a LAN, WAN or other network, from a combination of user inputs, network configuration maps, configuration scripts and local configuration files.

In constructing the network configuration map, a series of local configuration files are constructed for the network devices and appended to the network configuration map. The local configuration files contain information, for example, internet protocol (or "IP") address, default gateway, router name and simplified network management protocol (or "SNMP") community strings, necessary for the network device, for example, a router, to properly communicate on the network.

For each network device for which a local configuration file has been constructed, the network device configuration tool 10 may also construct a network device configuration file suitable for export to the network device itself. In this manner, remote configuration of network devices is enabled.

As shown in FIG. 1B, the network device configuration tool 10 may be representatively illustrated as being comprised of two software modules, map editor 14 and configuration guide 18, both of which are executable by the processor subsystem 4, which retrieve data and programming instructions from various locations within the memory subsystem 8 of the computer system 2 on which the network device configuration tool 10 is installed.

The data and programming instruction are stored in the memory subsystem 6 as a series of files which may be selectively accessed by the map editor 14 and/or the configuration guide 18. Files which are accessible to the map editor 14 and/or the configuration guide 18 are configuration scripts 12, map files 16, local configuration files 20 and network configuration files 22. The configuration scripts 12 identify the types of network devices and network entities which may be placed on the network configuration map and interconnected with other network entities and network devices. The configuration scripts 12 also identify the network devices which are configurable by the network device configuration tool 10 and contain information necessary to construct configuration files for those network devices. If a particular network device does not have a configuration script, a configuration file cannot be constructed by the network device configuration tool 10. The map files 16 contain a series of network configuration maps, each comprised of a series of interconnected network devices and network entities, constructed using the network device configuration tool 10. The local configuration files 20 contain information which, if uploaded to the corresponding network device 26, would enable configuration of that device. If local configuration files 20 are constructed for the network devices illustrated on the network configuration map(s) 16 produced using the network device configuration tool 10, such local configuration files 20 are associated with the corresponding network device such that they may be directly accessed from the network configuration maps 16.

The network configuration files 22 are similar in content to the local configuration files 20 except that the files have been formatted for upload to a network device 26 coupled to the configuration tool in a manner to be more fully described below. Broadly speaking, a local configuration file 20 is modified for upload to the corresponding network device 26 by formatting the local file into the appropriate IP address for the target network device 26. Finally, the network device configuration tool 10 includes a reverse parser 24 coupled to the local configuration files 20 and the network configuration files 22. The reverse parser 24 is used to construct a local configuration file 20 from a network configuration file 22 downloaded to the network configuration tool 10 by the network device 26.

It is contemplated that the network device configuration tool 10 would be installed in the computer system 2 operated by a network administrator and that plural network devices 26 and other network entities, only one of which is shown in FIG. 1B for ease of illustration, would be coupled to the network device configuration tool 10. Utilizing the network device configuration tool 10, the network administrator may build a representative network configuration map for the network. The network administrator may then configure remotely located network devices by uploading configuration files constructed during the process of building the network configuration map to the devices. Thus, by using the network configuration tool, the network administrator can, from a central location, design a suitable configuration network and then configure any number of remotely located devices included in the network.

The network device configuration tool 10 is coupled to the network device 26 by an asynchronous interface 28 and a boot protocol (or "bootp")/trivial file transfer protocol (or "TFTP") manager 30. Under the control of an asynchronous manager (not shown), a software process within the processor subsystem 4, the asynchronous interface 28 is used to exchange configuration information, for example, a network configuration file 20, by either an in-band transfer via in-band connection 29*a*, for example, via telnet, or by an out-of-band transfer via out-of-band connection 29*b*, for example, via modem. Additionally, the bootp/TFTP manager 30, another software process within the processor subsystem 4, controls the exchange of bootp and TFTP messages between the network device configuration tool 10 and the network device 26. Generally, a bootp exchange is used to transfer raw address and other basic information so that a TFTP exchange may then be used to transfer configuration information. The bootp/TFTP manager 30 also controls accesses to bootptab files 32.

As will be more fully described with respect to FIG. 3, below, the configuration scripts 12 are used to direct map editor 14 and configuration guide 18 in a guided configuration of a selected network device 26 by guiding in the construction of a configuration file for the device. Accordingly, turning momentarily to FIG. 2A, the configuration scripts 12 used to guide the configuration of a selected network device 26 will now be described in greater detail. As may now be seen, the configuration scripts 12 are comprised of a series of separate scripts 12-1 through 12-N, one for each type of device which may configured by the configuration tool 12. Each script 12-1 through 12-N is comprised of an attributes section 34, a bitmap section 36, a bitmap menu section 38 and a guided configuration section 40. Each of these sections 34, 36, 38 and 40 is a selectively executable set of commands which may be used during configuration of a device of the type corresponding to a particular script 12-1 through 12-N.

Turning now to FIG. 2B, the attributes section 34 is comprised of an icon portion 34*a*, a network entity portion 34*b*, a description portion 34*c* and a series of connection

portions 34*d*-1 through 34*d*-N. A valid icon filename identifying the graphical icon to be associated with the device type corresponding to the configuration script 12-N is contained in the icon portion 34*a*. As will be more fully described below, this icon will appear in a device window of a configuration GUI and can be dragged onto a network workspace to add a device of that type to a network configuration map. The network entity portion 34*b* provides a unique name for the type of device and appears in the device window under the icon. The description portion 34*c* defines a default description for the device which pre-populates the dialog box when a device type is dragged onto the network workspace. Finally, the connection portions 34*d*-1 through 34*d*-N provides connection statements for the device type. Specifically, a connection portion 34*d* will be provided for port, modular slot or other type of connection interface for the device type. Each connection statement will include a physical name for the port or other type of connection interface and the network entity names for all other types of devices which may be connected to the port. For example, if the network device was a modular router having 4 PCI slots, each connectable to ethernet, X.25, frame relay, PPP and IDSN type entities, and an ethernet port connectable to an ethernet entity, the attributes section 34 could be as set forth in the following code:

```
:ATTRIBUTES
ICON ROUTER.ICO
NETENTITY "Compaq Router"
DESCRIPTION "Modular and Fast"
CONNECT   "PCI SLOT 1"  "Ethernet"  "X.25"   "Frame Relay"
                        "PPP" "ISDN"
CONNECT   "PCI SLOT 2"  "Ethernet"  "X.25"   "Frame Relay"
                        "PPP" "ISDN"
CONNECT   "PCI SLOT 3"  "Ethernet"  "X.25"   "Frame Relay"
                        "PPP" "ISDN"
CONNECT   "PCI SLOT 4"  "Ethernet"  "X.25"   "Frame Relay"
                        "PPP" "ISDN"
CONNECT   "Ethernet Port" "Ethernet"
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```

Turning next to FIG. 2C, the bitmap section 36 defines the "drill down" bitmap which is presented to the network administrator upon requesting subsequent configuration of a configured network device. The bitmap section 36 also defines any necessary overlay bitmaps as well as provides the locations of "hot spots" on the bitmap. The bitmap is a graphical representation of the backplane of the configured device which provides connection information for the ports thereof. "Hot spots" on the bitmap are paths to additional information related to the connected ports for the configured network device.

Bitmap file portion 36*a* names a valid window bitmap format file which will be displayed in its own window when the network administrator double clicks on a configured network device. For each connected port of the configured network device, the bitmap section 36 will also include a location port portion 36*b*-1 through 36*b*-N which provides the location of the hot spot for the connected port on the bitmap. Finally, the bitmap section includes an overlay device bitmap file 36*c*-1 through 36*c*-x for each type of network device or entity which is connectable to the configured network device. Then, if the configured device is connected to that particular network entity, the network entity can be represented on the bitmap.

For example, if the bitmap 36 is comprised of a bitmap file 36*a*, port locations 36*b*-1 and 36*b*-2 and overlay device file 36*c*-1 as set forth in the sample code below:

```
BITMAP "router.bmp"
LOCATE "Slot 1" 20 40
LOCATE "Port 1" 50 90 70 120
OVERLAY "Ethernet" "TLAN.BMP"
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```

The bitmap 36 will include a representation of an ethernet-type network entity stored at TLAN.BMP drawn on top of the representation of a backplane of a router stored at ROUTER.BMP at coordinates 20, 40 if the "Ethernet"-type network entity is plugged into "Slot 1".

The bitmap menu section 38 defines a menu hierarchy presented to the user for hot spots, for example, connected slots, on the bitmap and the executable commands for each item included in a command menu. The command menu is displayed when the network administrator clicks on a connected slot on the bitmap. The bitmap menu section 38 is subdivided into network entity command sections 38*a*-1 through 38*a*-x. Specifically, for each network entity for which connection to the device is allowed, a corresponding network entity command section is provided such that, if that network entity is connected to the device, the commands defined in the section will be displayed to the network administrator for selective execution thereof.

The guided configuration section 40 defines the GUIs used to guide a user through configuration of a device and controls the configuration file to be constructed using user responses to the GUIs. As illustrated in FIG. 2D, the guided configuration section 40 is subdivided into a general script command portion 40*a* and a port script command portion 40*b*-1 through 40*b*-N for each port to which the device is connectable. A guided configuration script for a Cisco 2514 router is set forth in Appendix A by way of example and will be described in greater detail with respect to FIG. 3-D, below.

Returning now to FIG. 1B, the network device configuration tool 10 will now be described in greater detail. Generally, the map editor 14 controls the generation of a map of a network configuration while delegating the task of configuring unconfigured devices placed on the network configuration map to the configuration guide 18. Upon initiation of the configuration process, the map editor 14 selectively retrieves a map file 16, or creates a blank map, for editing. To add a device of a selected type to the network configuration map, the map editor 14 retrieves the corresponding configuration script 12-N from the configuration scripts 12 and, using the information contained in the retrieved configuration script 12-N, places an unconfigured device of the selected type on the network configuration map and appends a name for the device to the map. The map editor 14 performs all operations in which editing of the network configuration map is proposed. For example, if a connection between two devices placed on the network configuration map is proposed, the map editor 14 reviews the configuration scripts 12 for the devices and, if a connection between the two devices is permitted, the map editor 14 completes the proposed connection and appends the connection information to the network configuration map.

If a request to configure a device placed on the network configuration map is received, the map editor 14 transfers the name and connection information for the device to the configuration guide 18 and instructs the configuration guide 18 to perform the requested configuration task. For example, if configuration of a network device is requested, the configuration guide 18 will retrieve the configuration script 12-N for that type of network device and execute the

instructions contained in the guided configuration section 40 thereof. Using the information provided by the configuration script 12, the map editor 14 and input provided by the network administrator in response to execution of the instructions contained in the guided configuration section 40, the configuration guide 18 builds a local configuration file, associated with the device, for use by the network administrator and a corresponding network configuration file suitable for upload to the network device to enable configuration of the network device.

Referring next to FIG. 3A, the method for guiding configuration of a network device by constructing a configuration file for the network device which is the subject of the present invention shall now be described in greater detail. It should be clearly understood, however, that the illustrated order of steps is purely exemplary and should not be construed as limiting the scope of the invention. The method commences at step 42 by launching the network device configuration tool 10 from a platform such as Windows '95 by selecting an icon previously designated as providing a path to the network device configuration tool 10.

Proceeding to step 44, once launched, the network device configuration tool 10 generates a configuration manager GUI 100 (see FIG. 4) which provides a network workspace 102 and a device window 104. In the network workspace 102, a map comprised of any number of interconnected network devices, each having a configuration tied thereto, may be produced. The device window 104, on the other hand, displays all of the types of network devices which may be placed on the network workspace 102. Continuing on to step 46, for each type of network device for which a configuration script 12-N has been prepared and stored in the memory subsystem 6, the network device configuration tool 10 places an icon representative of the network device type in the device type window 104 to indicate to the user which types of network devices are configurable by the network device configuration tool 10. For example, the device window 104 illustrated in FIG. 4 includes icons representative of a PPP link, a vendor specific modular router, an ISDN-type WAN, an Ethernet-type LAN, a non-vendor specific computer subsystem, an X.25-type packet-switching WAN, and an ISDN-type WAN which subscribes to frame relay-mode service. At step 48, the network device configuration tool 10 loads a blank map into the network workspace 102. At this stage, the network device configuration tool 10 has completed loading the configuration manager GUI 100 and is ready to execute selected commands in response to inputs received from the network administrator via the user interface 9.

Proceeding on to step 50, the network administrator selects a command, either from one of the pull-down menus listed on the pull-down menu bar 108 or by depressing a command button displayed on command button bar 110. The menus displayed on the pull-down menu bar 108 are "file", "edit", "network", "window" and "help". By selecting one of these menus, a series of commands, each of which relates to the selected menu, are displayed. Available file commands are "new", "open", "save", "save as", "print", "print setup" and "exit". The new command clears the network workspace 102 of any network configuration map placed thereon. The open command allows the network administrator to select a network configuration map to be placed on the network workspace 102. The save and save as commands stores the map placed on the network workspace 102 to the memory subsystem 6. The print command prints the network configuration map placed on network workspace 102. The print setup command displays the printer configuration for the computer system 10. The exit command closes the network configuration tool.

Commands available under the edit menu are "draw mode", "move mode", "workspace properties", "edit device", "view/configure device", "delete device", "all ports connected configuration", "update configuration", "retrieve configuration", "associate configuration", "telnet to this device". The draw mode command allows the network administrator to draw connections between devices displayed on the network workspace 102. The workspace properties command is, in fact, a second pull-down menu which allows the network administrator to tailor the map placed in the network workspace 102. Commands available under the workspace properties menu are "view entity name", "view entity description", "view entity connections", "view ip addresses", "view ipx addresses", all of which add the listed information to the display of each device on the map, and the "snap to grid" and "view grid", both of which orientate the map to a grid.

The edit device command accesses the configuration information associated with a selected network device. The view/configure command displays a view of the backplane of a selected configured network device or, if the selected network device is unconfigured, defaults to the configuration dialog set forth in greater detail below. The delete device command removes a selected network device or entity from the network workspace. The all ports configured, update configuration provides access to a selected device's configuration file. The retrieve configuration file allows the network administrator to directly access a configuration file stored in the memory subsystem 6 while the associate configuration command permits the network administrator to append a configuration file to a device. The telnet to the device command initiates an in-band transfer of configuration information from the network device configuration tool 10 to the network device 26.

Commands available under the network menu are "bootptab maintenance", "enable bootp server", "disable bootp server", "enable TFTP server", "disable TFTP server" and "view network activity log". All of these commands are relate to the exchange of configuration information between the network device configuration tool 10 and the network device 26. More specifically, the bootptab maintenance command enables the network administrator to review previously constructed bootptab files 32. The enable/disable bootp server commands control the operation of the computer system 2 on which the network device configuration tool 10 operates as a bootp server, i.e. is capable of sending and/or receiving bootp messages via the bootp/TFTP manager 30. When enabled as a bootp server, the computer system 2 listens for bootp requests placed on the network by devices requesting configuration information. The enable/disable TFTP server commands control operation of the computer system 2 on which the network device configuration tool 10 operates as a TFTP server, i.e. is capable of sending and/or receiving TFTP messages via the bootp/TFTP interface 30. Finally, the view network activity log provides a historical display of exchanges between the network device configuration tool 10 and network devices requesting configuration.

Commands under the window menu are "arrange", "configuration files" "workspace", "requesting router" and "network devices". The arrange command is a pull-down menu which provides a set of commands which modify the appearance of the configuration management GUI 100. The configuration files command displays the configuration files stored in the memory subsystem. The workspace and net-

work device commands respectively move the network administrator to the network workspace 102 and the device window 104. Finally, the requesting router command provides a list of network devices 26 requesting IP addresses and configuration files from the network device configuration tool 10.

The command button bar 110 provides immediate execution of selected commands available from the pull-down menus 108. The commands which may be executed from the command button bar 110 are new, open, save, print, draw mode, move mode, network devices, workspace, requesting router, view network activity log and help.

Proceeding to step 52, the network administrator executes the command selected at step 50. For example, if the network administrator decides to retrieve an existing network configuration map stored in memory, the network administrator may click on the "open map" command button on the command button bar to display a list of map files 16 stored in memory and then select a map file to be opened. An exemplary network configuration map 106 which may be stored in memory is illustrated in FIG. 4. The network configuration map 106 is comprised of a vendor specific device 112, here, a modular router manufactured by Compaq Computer Corporation of Houston, Tex., having a first peripheral connection interface (or "PCI") slot coupled to a first ethernet-type LAN 114, a second PCI slot coupled to a second ethernet-type LAN 116, a third PCI slot coupled to a frame relay-type WAN 118 and an ethernet port coupled to a third ethernet-type LAN 120.

Continuing on to step 54, the network administrator then decides whether to edit the network configuration map 106 displayed in the network workspace 102. If the network administrator decides not to edit the network configuration map 106, the method proceeds to step 56 where the network administrator decides whether to execute another command. If so, the method returns to step 56. Otherwise, the network administrator closes the network configuration tool at step 58 to end the method.

Returning now to step 54, if the network administrator decides to go to the network workspace 102 to edit either the blank map initially loaded into the network workspace 102 at step 48 or, if a saved map was retrieved from the map files 16 by executing an "open file" command at step 52, the retrieved map loaded into the network workspace at step 52, the method proceeds to step 59 (FIG. 3B) where the network administrator decides whether to edit the map displayed in the network workspace 102. If the network administrator decides not to edit the map, the method returns to step 56 (FIG. 3A). If, however, the network administrator decides to edit the configuration network map 106 displayed in the network workspace 102 the method proceeds to step 60 where editing of the map commences.

At step 60, the network administrator may select a device type displayed in device type window 104 and add a device of the selected type to the map 106 displayed in network workspace 102. Proceeding to step 62, to add a device of a type displayed in the device type window 104 to the network configuration map 106 displayed in the network workspace 102, the user selects an icon representing a desired device type and, using the "drag and drop" process, places the icon on the network configuration map 106 displayed in the network workspace 102. For example, using a mouse or other conventional pointing device, the user would point to an icon representing the desired device type, select the device type by holding a leftmost button on the mouse in the depressed position, point to the desired position on the map and release the button. By doing so, a new device of the selected type is added to the network map. For example, in FIG. 7, a single network device, i.e., a modular router 122 manufacture by Compaq Computer Corporation, and a pair of network entities, i.e., ethernet type LANs 124 and 126 have been added to the network configuration map 106.

Each network device and/or network entity added to the network configuration map 106 is associated with a corresponding one of the configuration scripts 12-N. Accordingly, at step 64, the map editor 14 displays the name of the network device or entity contained in the attributes section 34 of the corresponding configuration script 12-N as the name of the newly added network device or entity. For example, the name of the network device 122 added to the network configuration map 106 is "Compaq Router".

Upon placing the, as yet unconnected, network device 122 and entities 124, 126 on the network configuration map 106, or if it was decided at step 60 to not add a network device or entity to the network configuration map 106, the method proceeds to step 66 where the network administrator decides whether to connect the newly added network devices and entities 122, 124 and 126 to other network devices or entities. For example, the network administrator may decide to connect the Compaq router 122 to the frame relay-type WAN 118, the ethernet-type LAN 124 and the ethernet-type LAN 126. If the network administrator decides to connect the Compaq router 122 to the ethernet-type LAN 124, the method proceeds to step 68 where the network administrator would select the Compaq router 122 by holding a leftmost button on the mouse in the depressed position while pointing to the Compaq router 122, draw a connection between the Compaq router 122 and the ethernet-type LAN 124 by repositioning the mouse to point at the ethernet-type LAN 124 while the button is depressed and releasing the button to complete the connection.

Continuing on to step 70, the map editor 14 determines whether the proposed connection is permissible. If the proposed connection is permitted, the line drawn by the network administrator is completed at step 72. The connection interface(s) for the origination device are then placed on the network configuration map 106 and the method continues on to step 74 for further editing of the network configuration map 106. For example, as shown in FIG. 7, PCI slot 1 of the Compaq router 122 has been used to connect the device to the ethernet-type LAN 126, PCI slot 2 to connect to the frame relay-type WAN 118 and PCI slot 4 to connect to the ethernet-type LAN 124. If, however, the proposed connection is not permitted, the line drawn by the user is deleted at step 76 before continuing on to step 74.

Returning to step 70, the method by which the map editor 14 determines whether the proposed connection is permitted will now be described in greater detail. An initial determination as to whether the proposed connection is permissible is made based upon the contents of the attributes section 34 of the configuration scripts 12-N for the devices placed on the map 106. For example, the configuration script for a Cisco 2514 router is set forth in the attached appendix. A portion of the attributes section of the configuration script contains the following code:

```
CONNECT   "ETHERNET0"   "Ethernet"
CONNECT   "ETHERNET1"   "Ethernet"
CONNECT   "SERIAL0"     "X.25" "Frame Relay" "PPP" "HDLC"
CONNECT   "SERIAL1"     "X.25" "Frame Relay" "PPP" "HDLC"
```


This portion of the configuration script code contains considerable connection information for the device.

Specifically, the device has four connection interfaces—two ethernet ports and two serial ports. Furthermore, the two ethernet ports are only connectable to an ethernet-type LAN entities device while the two serial ports are connectable only to X.25, frame relay, PPP and HDLC entities. Accordingly, at step 70, the mapper compares the list of network device or entity types which are connectable for the two devices and/or entities for which connection is proposed. If the devices and/or entities are connectable, the method proceeds to step 72 where connection of the two devices and/or continues.

Turning momentarily to FIG. 3D, the step of connecting the two devices and/or entities will now be described in greater detail. The method commences at step 150 and continues on to step 152 where the configuration file for the origination device or entity is reviewed to determine if the origination device or entity has an available slot which is connectable to the destination device or entity and to step 154 where the configuration file for the destination device or entity is reviewed to determine if the destination device or entity has an available slot which is connectable to the origination device or entity. If either the origination or destination device or entity do not have an available slot which is connectable to the other device or entity, a determination is made at step 156 that the devices/entities cannot be connected. The proposed connection is then deleted at step 158 and, continuing on to step 166, the method returns to step 72.

Returning to step 154, if it is determined that both the origination and destination devices or entities have available slots, the method proceeds to step 160 where a connection interface is selected for the originating device and on to step 162 where a connection interface is selected for the destination device or entity. At both of these steps, the network administrator may select any one of a list of available connection interfaces overlayed on the network configuration map 106 by the network device configuration tool 10. If only one connection interface is available for a device or entity, however, the map will automatically select the available interface and indicate its selection of the connection interface to the network administrator. Upon selecting connection interfaces for the devices or entities, the method proceeds to step 164 where the selected connection interface for the device 122 is displayed on the network configuration map 106 and on to step 166 for a return to step 72.

Upon either a decision not to connect devices or entities at step 66, a completion of a proposed connection at step 72 or a deletion of a proposed connection at step 76, the method proceeds to step 74 where the network administrator decides whether to configure a device. To initiate configuration of a selected unconfigured device, the network administrator double clicks on the device to be configured. At step 78 (FIG. 3C) the configuration guide 18 retrieves the guided configuration section 40 from the configuration script 12-N for the type of device to be configured and, proceeding to step 80, executes the script commands contained in the general script commands portion 40a of the guided configuration section 40. In turn, the execution of the script commands causes a series of questions to be asked of the network administrator, the answers to which are used to construct a configuration file. For example, if the script commands set forth in the guided configuration section of the configuration script set forth in Appendix A were executed during configuration of a Cisco 2514 router, the network administrator would be asked to name the router, indicate whether to configure internet protocol (or "IP") for the router, indicate which IP routing protocol should be used for the router, whether to configure IPX for the router, indicate whether the router should be password protected, choose a password for the router, indicate whether the configuration mode for the router should be password protected and choose a password for the configuration mode.

Proceeding to step 82, the configuration guide 18 determines whether any ports of the device being configured are connected to a second device or entity. If any of the ports are connected, the method proceeds to step 84 where the configuration guide 18 executes the script commands for the connected ports. For example, if serial port 1 of a Cisco router 2514 was connected to a WAN, the configuration guide 18 would execute the script commands set forth in serial1 portion of the script commands set forth in Appendix A. Thus, in this example, the network administrator would be asked whether the serial port should be configured, the IP address and mask for the port, the IPX network number, whether the port should be configured for frame relay, the type of connector being used for the port, the local data link connection identifier (or "DLCI"), the Committed Information Rate (or "CIR") and the Excess Information Rate (or "EIR") for the port and whether to use compression.

The configuration guide 18 collects the information necessary to configure the device by engaging the network administrator in a dialog during which the configuration guide 18 generates a series of GUIs, each of which displays a request for information and provides areas in which the requested information may be inputted and buttons for guiding the network administrator through the dialogue. By way of example, an IP address GUI 200 is illustrated in FIG. 5. The network administrator may input the IP address and mask for the indicated slot and device by respectively entering the IP address and mask in areas 202 and 204. The network administrator may also review a prior GUI in the dialogue by depressing button 206, proceed to the next GUI in the dialogue by depressing button 208, request help by depressing button 210 or exit the configuration dialog by depressing button 212.

Upon successful execution of the script commands for the connected ports at step 84, or if it was determined at step 82 that no ports are connected for the device being configured, the configuration dialog is completed at step 86 and, at step 88, the information provided by the network administrator during the dialogue is used to construct a local configuration file 20 for the device. If desired, the network administrator may view the local configuration file 20 constructed during this process at step 90, directly edit any of the configuration commands contained therein at step 92 before saving the constructed local configuration file 20 to the memory subsystem and associating it with the device. Selected portions of the configuration information contained in the local configuration file 20 may be displayed on the network configuration map 106. For example, FIG. 7 displays the IP address and mask for PCI slot 1 of the Compaq router 122 which was input by the network administrator during configuration of the device. The network configuration map 106 may also include a indicator 128, for example, a loop surrounding a device, which indicates that a device has been configured.

Having successfully constructed a local configuration file 20 and associated it with the device being configured, the method proceeds to step 96 (FIG. 3B) where the network administrator decides whether to upload the configuration file to the device. If upload is selected, the method proceeds to step 97 where the constructed configuration file is uploaded to the network device 26. Various mechanisms may be used to upload a constructed configuration file to the

network device 26. For example, in many circumstances, an in-band transfer of the configuration file via telnet may be used. In other circumstances, other mechanisms more fully described below may be necessary to transfer configuration information to the network device 26.

While constructing a local configuration file for a device, the network device configuration tool 10 also constructs a bootptab file for the device. The bootptab file is particularly useful in those situations where the network administrator decides not to upload the configuration file upon completing the construction thereof, for example, if the network device is unconnected, powered down or otherwise unavailable. A bootptab file for a device contains the serial number for the device to be configured, an IP address to assign to the device to be configured and the configuration file to be uploaded to the device. As will be more fully described with respect to FIGS. 8–9, below, the bootptab file provides information necessary for unattended remote configuration of network devices as they are connected to the network.

Returning now to FIG. 3B, after completing upload of the configuration file at step 97, or if the network administrator decided at step 96 not to upload the configuration file, the method proceeds to step 98 where the network administrator decides whether to perform subsequent configuration on a device on the network configuration map 106. If subsequent configuration of a device is selected, the method proceeds to step 99 where subsequent configuration of a selected device is performed from a backplane bitmap of the selected device. To select a device for subsequent configuration, the network administrator double clicks on a configured device included on the network configuration map 106. By doing so, a bitmap of the backplane of the selected configured device is displayed.

FIG. 6 illustrates a backplane bitmap 220 for the Compaq router 122 of FIG. 7. As may now be seen, the various connection interfaces used to connect the router 122 to network entities, as well as unconnected connection interfaces, are graphically displayed on the backplane bitmap 220 using the information contained in the bitmap section 36 of the configuration script 12-N and the local configuration file 20 for the Compaq router 122. Specifically, for the Compaq router 122, PCI slot 1 has been used to provide a first ethernet connection 222, PCI slot 2, an HSSI connection 224 and PCI slot 4, a second ethernet 226. PCI slot 3, however, remains unconnected. From the backplane bitmap 220, the network administrator may view the settings for a port by double clicking on a selected port or, by depressing the right mouse button, bring up a pull down menu of commands contained in the network entity commands section 38a-x of the bitmap menu 38 for the network entity connected to the selected port and select any of the configuration commands listed on the pull down menu for execution.

After completing subsequent configuration of the device at step 99, or if the network administrator decided at step 98 not to perform subsequent configuration, the method returns to step 56 (FIG. 3A).

Turning next to FIG. 8, a method of transmitting configuration information to a network device 26 in accordance with the teachings of the present invention shall now be described in greater detail. The method commences at step 250 by launching the network device configuration tool 10. As previously stated with respect to FIG. 3A, launch of the network device configuration tool 10 initiates the generation of the configuration manager GUI 100. In addition, launch of the network device configuration tool 10 initiates listening, by the network device configuration tool 10 at step 252, for the presence of unconfigured network devices 26 on the network.

Proceeding to step 254, the network device configuration tool 10 will detect bootp packets transmitted on the network and determine if the bootp packet was issued by a device requesting configuration information from the network device configuration tool 10. More specifically, if an unconfigured network device 26 powers up on the network, the unconfigured network device 26 will periodically issue a bootp packet which contains a medium access code (or "MAC") address for the device and a code which indicates that the device is requesting configuration information. For example, the code may be placed in the vendor specific field of the bootp packet. If a detected bootp packet does not contain a request for configuration information, the method returns to step 252 where the configuration tool continues to listen for bootp packets.

If, however, the network device configuration tool 10 determines at step 256 that the issuing device is requesting configuration information, for example, by matching a request code held by the network device configuration tool 10 with a corresponding code contained in the detected bootp packet, the method proceeds to step 258 where the network device configuration tool 10 will determine if the device requesting configuration information has a corresponding bootptab file 32 and if the description of the device requesting configuration information matches the device drawn on the network configuration map 106.

In order to determine whether the device requesting configuration information has a corresponding bootptab file 32 and if the description of the device matches the device drawn on the network configuration map, the attributes section 34 must be modified to include two additional portions—bootpid and subdeviceid. The bootpid portion contains a number unique to a particular device type and model number. The subdeviceid identifies the type of devices installed in the device. For example, if the network device was a modular router having 4 PCI slots, each connectable to ethernet, X.25, frame relay, PPP and IDSN type entities, and an ethernet port connectable to an ethernet entity with a ThunderLan board connectable to ethernet entities, a W-Adapter connectable to X.25, frame relay and PPP entities and a Basic Rate ISDN Board connectable to ISDN entities installed therein, the attributes section 34 could be as set forth in the following code:

```
:ATTRIBUTES
ICON ROUTER.ICO
NETENTITY "Compaq Router"
DESCRIPTION "Modular and Fast"
CONNECT   "PCI SLOT 1"  "Ethernet"  "X.25"   "Frame Relay"
                        "PPP" "ISDN"
CONNECT   "PCI SLOT 2"  "Ethernet"  "X.25"   "Frame Relay"
                        "PPP" "ISDN"
CONNECT   "PCI SLOT 3"  "Ethernet"  "X.25"   "Frame Relay"
                        "PPP" "ISDN"
CONNECT   "PCI SLOT 4"  "Ethernet"  "X.25"   "Frame Relay"
                        "PPP" "ISDN"
CONNECT   "Ethernet Port" "Ethernet"
bootpid 103
subdeviceid 11 "ThunderLan board" "Ethernet"
subdeviceid 12 "W-Adapter" "X.25" *2 "Frame Relay"
               *2 "PPP" *2
subdeviceid 13 "Basic Rate ISDN Board" "ISDN"
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```

The guided configuration section would be similarly modified to include an additional command script portion which, upon execution thereof, will issue any additional requests for information, for example, installed devices, necessary to construct the bootptab file described herein such that a determination as to whether the description of the device

requesting configuration matches the device drawn on the network configuration map 106.

Proceeding to step 260, if the device requesting configuration has a matching bootptab file, i.e., the bootptab file has a bootpid which matches the serial number of a device having a bootptab file and if the devices installed in the device requesting configuration match the devices identified in the subdeviceid portion of the configuration file for the matching bootptab file, the network device configuration tool 10 issues a bootp reply at step 260. The bootp reply contains the filename which matches the configuration file described in the matching bootptab file. Using the filename contained in the bootp reply, at step 262, the device requesting configuration may issue a TFTP request for configuration information to the network device configuration tool 10 which identifies the configuration file containing its configuration information.

Continuing on to step 264, in response to the TFTP request containing the filename of a configuration file issued by the device requesting configuration, the network device configuration tool 10 responds by issuing the requested configuration file to the device. At step 266, the unconfigured network device configures itself using the information contained in the configuration file transmitted thereto by the network device configuration tool 10 and, at step 268, the method ends.

Returning to step 258, if the device requesting configuration does not have a matching bootptab file, the method proceeds to step 270 where the network device configuration tool 10 generates a pop-up requesting device GUI 300 which overlays a portion of the configuration manager GUI 100. A requesting device GUI 300 is illustrated in FIG. 9. As illustrated herein, the requesting device GUI 300 includes an icon representing the unconfigured network device 302 requesting configuration.

Proceeding to step 272, the network administrator may select one of two options to configure the device requesting configuration. If the network administrator decides that the device 302 is a new device, the requesting device may be dropped onto the network workspace 102, thereby adding the requesting device to the network configuration map 106 as an unconnected device. Proceeding on to step 274, the method would return to step 64 (FIG. 3B) wherein the previously discussed process of constructing a configuration file and uploading the configuration file to the unconfigured network device may be completed to configure the device requesting configuration.

Returning to step 272 and, now proceeding to step 276, the network administrator may instead opt to drop the device 302 requesting configuration onto an existing device, for example, router 112, already included on the network configuration map 106. By dropping the device 302 requesting configuration onto an existing device on the network configuration map 106, the network administrator is indicating that the device 302 requesting configuration is the same device that is already on the network configuration map 106 but, due to a difference between the description of the device 302 in the bootptab and the description of the device 112 contained in the corresponding configuration file, the network device configuration tool 10 is unable to recognize that the two are the same device.

Proceeding on to step 278, the network device configuration tool 10 would reconcile the configuration file and the bootptab file for the device. If the two are irreconcilable, the method terminates at step 280. If the two can be reconciled, the configuration file is revised appropriately at step 282 and the method then returns to step 264 so that the network device configuration tool 10 may issue the revised configuration file to the device 302 requesting configuration in the manner previously described. To reconcile the device 302 requesting configuration and an existing device such as the router 112, the network device configuration tool 10 reviews the devices installed on the device requesting configuration match the devices installed. If the installed devices match, then the configuration file is modified using the contents of the bootptab file. The method then proceeds to step 264 so that the network device configuration tool 10 may issue the revised configuration file to the device 302 requesting configuration.

Thus, there has been described and illustrated herein a configuration manager for network devices and an associated method of providing configuration information to a network device. However, those skilled in the art will recognize that many modifications and variations besides those specifically mentioned may be made in the techniques described herein without departing substantially from the concept of the present invention. Accordingly, it should be clearly understood that the form of the invention described herein is exemplary only and is not intended as a limitation on the scope of the invention.

APPENDIX "A"

```
File: 2514.DEV

:ATTRIBUTES
ICON ROUTER.ICO
NETENTITY "Cisco 2514"
DESCRIPTION "Cisco IOS"

CONNECT "ETHERNET0" "Ethernet"
CONNECT "ETHERNET1" "Ethernet"
CONNECT "SERIAL0"   "X.25" "Frame Relay" "PPP"  "HDLC"
CONNECT "SERIAL1"   "X.25" "Frame Relay" "PPP"  "HDLC"

:GUIDED_CONFIG

     use 2514vars.use
     frame
     askstring routername "What do you want to name this
router?" minlen 2 maxlen 20
     savefilename $routername "-confg"
     addconfig "hostname  " $routername

     frame
     radio configip "Do you want to configure IP on this
router?" "Yes" "No"
     if $configip = "Yes" then
                    frame
                      radio routeprot "What IP routing
protocol do you want to use?"
"RIP"  "IGRP"
                    addconfig " !"
                    addconfig " ! IP routing protocol to
use"
                    addconfig " !"
                    addconfig "router  " $routeprot
                    addconfig " !"
     endif

     frame
     radio configipx "Do you want to configure IPX on
this router?" "Yes" "No"
     if $configipix = "Yes" then
                    addconfig " !"
                    addconfig " ! Enable IPX routing"
                    addconfig " !"
```

```
                    addconfig "ipx routing"
                    addconfig " !"
                    frame
                    radio yesno "Do you want password
protect configuration mode?"
"Yes" "No"
                    if $yesno = "Yes" then
                                   askpass enablepassword
"Enter password for
configuration mode" minlen 5 maxlen 20
                                   addconfig " !"
                                     addconfig  "enable
password " $password
                                   addconfig " !"
                    endif

     endif
     frame
     addconfig " !"
     addconfig "no ip domain-lookup"
     addconfig " !"

;ETHERNETO

     frame
     assign portname "Ethernet0"
     use 2514eth.use

;ETHERNET1

     frame
     assign portname "Ethernet1"
     use 2514eth.use

;SERIALO

     frame
     assign portname "SERIAL0"
     use 2514wan.use

;SERIAL1

     frame
     assign portname "SERIAL1"
     use 2514wan.use
```

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```
;BITMAP
bitmap          2514.bmp

locate              "ETHERNET0"    56   69    87   79
locate              "ETHERNET1"    110  69    141  79
locate              "SERIAL0"      250  64    302  82
locate              "SERIAL1"      326  64    377  82

:BITMAP_MENU

;Ethernet

menu "Something"
     menuitem "Pick me"
          define string 80
          askstring string "Enter something"

          addconfig "you entered " $string
menuend

;Serial0

menu "No items available yet"

;PROMPTS
"Password:"
"-More-"
```

File: 2514vars.use

```
# variables to use with the Cisco 2514 config scripts
(2514*.*)
define configip          3
define configipx         3
define routeprot         4
define password          30
define enablepassword    30
define ipaddress         15
define ipmask            15
define ipxaddress        20
define ipxencap          15
define lpsz              80
define portname          10
define yesno             3
define frconnector       10
```

```
define frdici             3
define frcir              4
define freir              4
define frportspeed        4
define pppmtu             5
define pppauth            4
define pppcompress        10
define ppplapb            3
define ppptacacs          3
define pppconnector       5
define routername         30
```

File: 2514eth.use

```
     assign lpsz "Do you want to configure " $portname
"?"
     radio yesno $lpsz "Yes" "No"
     if $yesno = "Yes" then

          addconfig " !" $Sportname "configuration
commands"
          addconfig " !"
          addconfig "interface " $portname
          addconfig " !"

          if $configip = "Yes" then

               frame
               getip ipaddress ipmask
               askip ipaddress ipmask "Enter IP network
that interface is plugged
 into"

               addconfig " !"
               addconfig " ! IP related commands"
               addconfig " !"
               addconfig "ip address " $ipaddress " "
$ipmask
               addconfig " !"
               assignip $ipaddress $ipmask

          endif

          if $configipx = "Yes" then
```

```
                frame
                getipx ipxaddress
                askstring ipxaddress "Enter IPX network
number for this interface"
hex maxlen 8
                frame
                 radio  ipxencap  "What  type  of  IPX
ethernet encapsulation should be
used?"  "ARPA" "Novell-Ether"  "SAP"  "SNAP"
                addconfig " !"
                addconfig " ! IPX related commands"
                addconfig " !"
                 addconfig "ipx network " $ipxaddress
                addconfig "ipx encap " $ipxencap
                addconfig " !"
                assignipx $ipxaddress

           endif
      endif

File: 2514wan.use
      assign lpsz "Do you want to configure " $portname
"?"
      radio yesno $lpsz "Yes" "No"

      if $yesno = "Yes" then

           addconfig " !"
           addconfig " ! "  $portname " configuration
commands"
           addconfig "interface " $portname
           addconfig " !"

           if $configip = "Yes" then

           frame
           assign lpsz "Enter IP address for " $portname
           askip ipaddress ipmask $lpsz
           addconfig "!"
           addconfig "! IP related commands"
           addconfig "!"
           addconfig "ip address " $ipaddress " " $ipmask
      endif

      if $configipx = "Yes" then
           frame
```

```
          assign lpsz "Enter IPX network number for "
$portname
          askstring ipxaddress $lpsz hex maxlen 8
          addconfig " !"
          addconfig " ! IPX related commands"
          addconfig " !"
          addconfig "novell address " $ipxaddress
          addconfig " !"
     endif

     if $connected = "Frame Relay" then

          frame
          assign lpsz "Would you like to configure Frame
Relay for "
$portname "?"
          assign yesno "Yes"
          radio yesno $lpsz "Yes" "No"
          if $yesno - "Yes" then

               addconfig " !"
               radio yesno $lpsz "Yes" "No"
               if $yesno = "Yes" then

                    addconfig " !"
                    addconfig " ! Set Encapsulation to
Frame Relay"
                    addconfig "encapsulation frame-relay"

#                   radio frconnector "What connector
type are you using?" "RS-232" "V.35"
                    askstring frdlci "What is your local
DLCI" MIN 16 MAX 996
                    # set DLCI command
                    assign lpsz "What is " $portname
"Physical Port Line Speed (Kbps)"
                    askstring frportspeed $lpsz MIN 1.2
MAX 2048
                    # set port speed command
                    assign lpsz "What is the Committed
Information Rate (CIR)
for " $portname "?"
                    askstring frcir $lpsz MIN 1.2 MAX
2048
                    # set CIR command
```

```
                    assign lpsz "What is the Excess
Information Rate (EIR) for "
$portname "?"
                    askstring freir $lpsz MIN 1.2 MAX
2048
                    # formula goes here
                    # set EIR command
                    radio yesno "Do you want to use
compression?" "Yes" "No"
                    # if goes here
                    # set compression command
#OTHER PARAMETERS to set (some under advanced button)
#frportspeed
#frcir
#frier
#frremname
#frconnrtr
#frcompress
#frnettype
#frmaxframe
#frcongmonper
#frmeasint
#frlit
#frpvt
#frfsef
#fret
#frcet
#frclocking
#fremulate
#fremulate
#frlinestate
#map
                    display "<more frame relay questions
would normally follow>"
               endif
          else
          if $connected = "PPP" then

               frame
               assign lpsz "Would you like to configure
PPP for " Sportname "?"
               assign yesno "Yes"
               radio yesno $lpsz "Yes" "No"
               if $yesno = "Yes" then

# Set defaults
```

```
                    assign ppmtu "1500"
                    assign pppauth "CHAP"
                    assign pppcompress "Stacker"
                    assign ppplapb "No"
                    assign ppptacacs "No"

                    addconfig " !"
                    addconfig " ! Set Encapsulation to
PPP"
                    addconfig "encapsulation ppp"

#               radio pppconnector "What connector type
are you using?"  "RS-232"
"V.35"

                    frame
                    radio pppauth "What authentication
protocol are you using?"
"PAP"  "CHAP"  "Off"
                    if $pppauth <> "Off" then
                        addconfig " !"
                        addconfig " ! PPP Authorization
related
commands"
                        addconfig " !"
                        addconfig "no ppp
authentication"
                    endif
                endif

                frame
                radio pppcompress "What compression method
are you using?"
"Predictor" "Stacker" "Off"
                if $pppcompress <> "Off" then
                    addconfig " !"
                    addconfig " ! PPP Compression related
commands"
                    addconfig " !"
                    addconfig "ppp compress "
$pppcompress
                else
                    if $pppcompress = "Off" then
                        addconfig " !"
                        addconfig " ! PPP Compression
related commands"
```

```
                    addconfig " !"
                    addconfig "no ppp compression"
                endif
            endif

            frame
            radio ppplapb "Use LAPB with PPP for
reliable link?" "Yes"
"No"
            if $ppplapb = "Yes" then
                addconfig " !"
                addconfig " ! PPP LAPB with PPP for
reliable link related commands"
                addconfig " !"
                addconfig "ppp reliable-link"
            else
                addconfig " !"
                addconfig " ! PPP LAPB with PPP for
reliable link
related commands"
                addconfig " !"
                addconfig "no ppp reliable-link"
            endif
            frame

            radio ppptacacs "Use TACACS to verify PPP
authentication?"
"Yes" "No"
            if $ppptacacs = "Yes" then
                addconfig " !
                addconfig " ! Use TACACS to verify
PPP authentication
                addconfig "ppp use-tacacs"
            else
                addconfig " !"
                addconfig " ! Use TACACS to verify
PPP authentication"
                addconfig " !"
                addconfig "no ppp use-tacacs"
            endif

                frame
                assign lpsz "What is the Maximum
Transmission Unit for "
$portname "?"
```

```
                    askstring pppmtu $lpsz MIN 64 MAX
4096
                    addconfig " !
                    addconfig    "    !    Set    Maximum
Transmission Unit"
                    addconfig "mtu " $pppmtu
                    addconfig "ip mtu " $pppmtu
               endif

          else

               display $portname " is connected to a "
$connected " network"
               display "appropriate guided configuration
commands would appear here"
          endif
     endif
```

What is claimed is:

1. For a computer system having a processor subsystem and a memory subsystem coupled by a system bus for bi-directional exchanges therebetween, a configuration manager for configuring a network device remotely coupled thereto, said configuration manager comprising:

at least one configuration script stored in said memory subsystem, said configuration script containing a series of executable instructions for constructing a configuration file and a bootptab file for a first specified type network device, said configuration script including at least a first section containing a series of configuration commands which generate requests for information, and a second section containing a set of connection rules for connecting said first specified type of network device to at least one other specified type of network device, and where said second section of said configuration script includes at least (i) an identifier for each connection interface of said first specified type of network device and (ii) a list of network device types that can be connected to the connection interface associated therewith, said list being provided for each of said identifiers;

a first software module, executable by said processor subsystem, for constructing a configuration file suitable for upload to a network device of said first specified type and a bootptab file suitable for identifying said network device, said first software module constructing said configuration file and said bootptab file by executing said series of executable instructions contained in said configuration script; and

a second software module, executable by said processor subsystem, for processing a configuration request issued by said network device by identifying said network device using said constructed bootptab file and configuring said network device by uploading said constructed configuration file thereto.

2. A configuration manager for configuring a network device remotely coupled thereto according to claim 1 wherein information received by said first software module in response to said requests for information is used to construct said configuration file and said bootptab file.

3. A configuration manager for configuring a network device remotely coupled thereto according to claim 1 and wherein said second section of said configuration script further comprises:

a first portion which uniquely identifies said network device; and

a second portion which identifies devices installed in said network device.

4. A configuration manager for configuring a network device remotely coupled thereto according to claim 3 and wherein said first section of said configuration script further comprises:

a first portion corresponding to each of said at least one other specified type of network device specified in said connection rules contained in said second section of said configuration script;

said first portion containing a subset of said series of configuration commands which are executed only if said network device for which said configuration file is being constructed is connected to a network device of said other specified type of network device.

5. A computer-implemented method for configuring a remotely located network device, comprising the steps of:

providing a configuration script containing a series of executable instructions for constructing a configuration file for a first specified type of network device, said configuration script including a first section containing a series of configuration commands and a second section containing a set of connection rules for connecting said first specified type of network device to at least one other specified type of network device, and where said second section of said configuration script includes at least (i) an identifier for each connection interface of said first specified type of network device and (ii) a list of network device types that can be connected to the connection interface associated therewith, said list being provided for each of said identifiers;

constructing a configuration file by executing said series of instructions contained in said configuration script;

detecting a request for configuration issued by a network device;

determining if said configuration file corresponds to said network device issuing said request for configuration;

if said configuration file corresponds to said network device, issuing a reply to said request for configuration that identifies said configuration file to said network device; and

issuing said configuration file to said network device in response to a request for configuration file which identifies said configuration file.

6. A computer-implemented method for configuring a remotely located network device according to claim 5 and further comprising the steps of:

generating requests for information by executing said series of configuration commands contained in said first section of said configuration script; and

constructing said configuration file using information received in response to said requests for information.

7. A computer-implemented method for configuring a remotely located network device according to claim 6 and further comprising the steps of:

constructing a bootptab file which contains a unique identifier and said configuration file for said network device.

8. A computer-implemented method for configuring a remotely located network device according to claim 7 wherein the step of determining if said configuration file corresponds to said network device issuing said request for configuration further comprises the steps of:

determining if said network device issuing said request for configuration has an identification code which matches an identification code contained in said bootptab file; and

determining if devices installed in said network device issuing said request for configuration matches installed devices identified in said bootptab file.

9. A computer-implemented method for configuring a remotely located network device according to claim 5 wherein the step of providing a configuration script containing a series of executable instructions further comprises the step of:

providing a configuration script which includes, within said second section, a first portion corresponding to each of said at least one other specified type of network device specified in said connection rules contained in said second section of said configuration script;

each said first portion containing a subset of said series of configuration commands.

10. A computer-implemented method for configuring a remotely located network device according to claim 9 and further comprising the step of:

executing said subset of said series of configuration commands contained in each said first portion only if said network device for which said configuration file is being constructed is connected to a network device of said other specified type of network device.

11. For a computer system having a processor subsystem and a memory subsystem coupled by a system bus for bidirectional exchanges therebetween, an apparatus for constructing configuration files for network devices, comprising:

a plurality of configuration scripts for various different types of network devices, said configuration scripts being stored in said memory subsystem, and each of the configuration scripts being used to construct a configuration file and a bootptab file, the bootptab files being constructed are used to assist with remote configuration of network devices including at least one connection statement for each connection port of the associated one of the network devices, the connection statements included in said configuration scripts comprise connection rules that specify permissible connections between the ports of the various different types of network devices and other of the network devices, the connection rules include an identifier for the associated port and a list of network devices that are permitted to connect to the associated port;

first computer program code for enabling selection of a particular one of the various different types of network devices; and

second computer program code for executing the one of said configuration scripts associated with the particular one of the various different types of network devices to produce a configuration file and a bootptab file for the particular one of the various different types of network devices.

12. An apparatus for constructing a configuration files for network devices according to claim 11, wherein the configuration scripts includes at least one connection statement for each connection port of the associated one of the network devices, and a series of commands, the series of commands associated with a particular one of said configuration scripts are executed by said second computer program when said second computer program code executes the particular one of said configuration scripts.

13. An apparatus for constructing a configuration files for network devices according to claim 12, wherein said apparatus further comprises:

third computer program code for uploading said configuration file to a network device of the particular one of the various different types of network devices.

14. An apparatus for constructing a configuration files for network devices according to claim 12, wherein the executing of the one of said configuration scripts by said second computer program code prompts a user of said apparatus to enter information, and the entered information is used by said second computer program code in producing the configuration file.

15. For a computer system having a processor subsystem and a memory subsystem coupled by a system bus for bidirectional exchanges therebetween, an apparatus for constructing configuration files for network devices, comprising:

a plurality of configuration scripts for various different types of network devices, said configuration scripts being stored in said memory subsystem, and each of the configuration scripts being used to construct a configuration file and a bootptab file, the bootptab files being constructed are used to assist with remote configuration of network devices including at least one connection statement for each connection port of the associated one of the network devices;

first computer program code for enabling selection of a particular one of the various different types of network devices;

second computer program code for executing the one of said configuration scripts associated with the particular one of the various different types of network devices to produce a configuration file and a bootptab file for the particular one of the various different types of network devices;

third computer program code for detecting a request for configuration issued by a connecting network device;

fourth computer program code for determining if a configuration file already exists for the network device based on the bootptab file associated with the connecting network device issuing the request for configuration; and

fifth computer program code for issuing a reply to the request for configuration that identifies the appropriate configuration file for the network device when said fourth computer program code determines that the configuration file already exists for the connecting network device; and

sixth computer program code for directing execution of at least a portion of said second computer code to produce a configuration file and then issuing the produced configuration file to the connecting network device when said fourth computer program code determines that the configuration file does not exist for the connecting network device.

16. An apparatus for constructing a configuration files for network devices according to claim 15, wherein the configuration scripts includes at least one connection statement for each connection port of the associated one of the network devices.

17. An apparatus for constructing a configuration files for network devices according to claim 16, wherein each of the configuration scripts further includes a series of commands, and

wherein the series of commands associated with a particular one of said configuration scripts are executed by said second computer program when said second computer program code executes the particular one of said configuration scripts.

18. An apparatus for constructing a configuration files for network devices according to claim 17,

wherein dialog screens for the user to input information are produced when said second computer program code executes the one of said configuration scripts associated with the particular one of the various different types of network devices, and the dialog screens prompt the user to enter the input information, and the input information that the user enters is used by said second computer program in producing the configuration file.

* * * * *

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Chui (43) Pub. Date: Nov. 7, 2002

(54) MULTI-SERVICE OPTICAL INFINIBAND ROUTER

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(51) Int. Cl.[7] G06F 15/16; G06F 15/173
(52) U.S. Cl. 709/238; 709/230

(57) ABSTRACT

This invention pertains a system and method for interconnecting processing module within a computer device and the input/output channels external to the computer devices. More specifically, the Multi-Service Optical InfiniBand Router (OIR) relates to the use of a device to communicate with InfiniBand devices, IP-based switching devices, IP-based routing devices, SONET Add-Drop Multiplexing devices, DWDM (Dense Wavelength Division Multiplexing) devices, Fibre Channel devices, and SCSI devices.

InfiniBand System Architecture

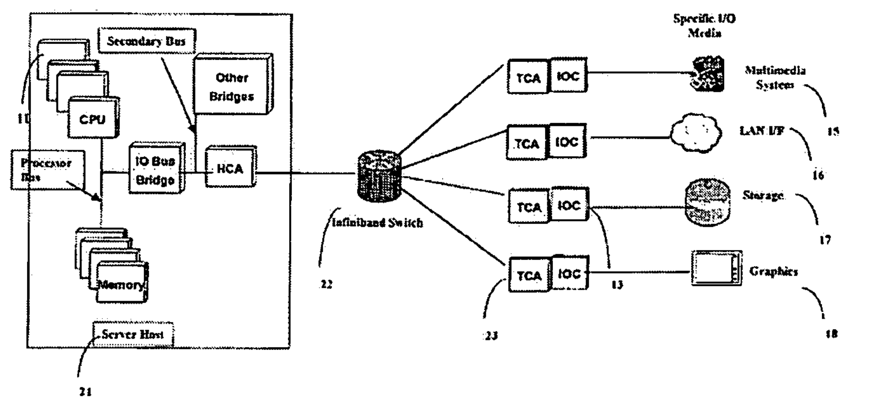


Figure 1. Traditional System Architecture

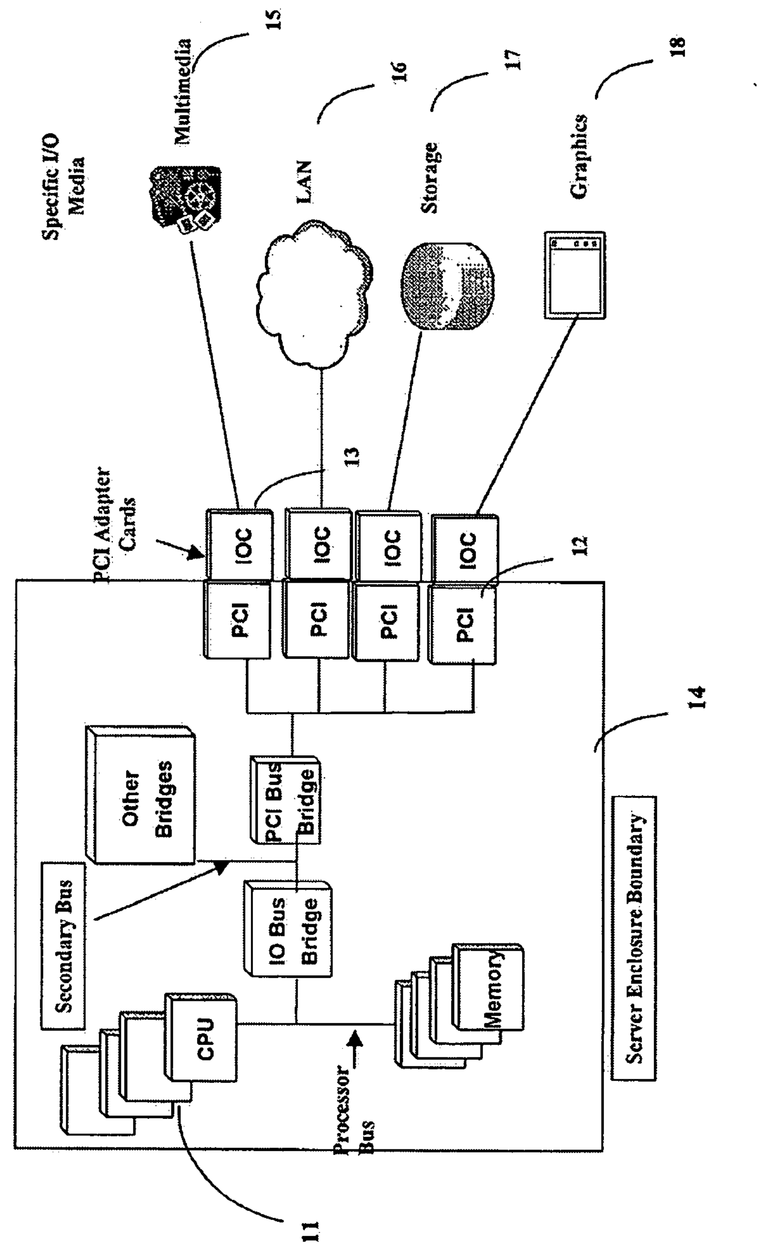


Figure 2. InfiniBand System Architecture

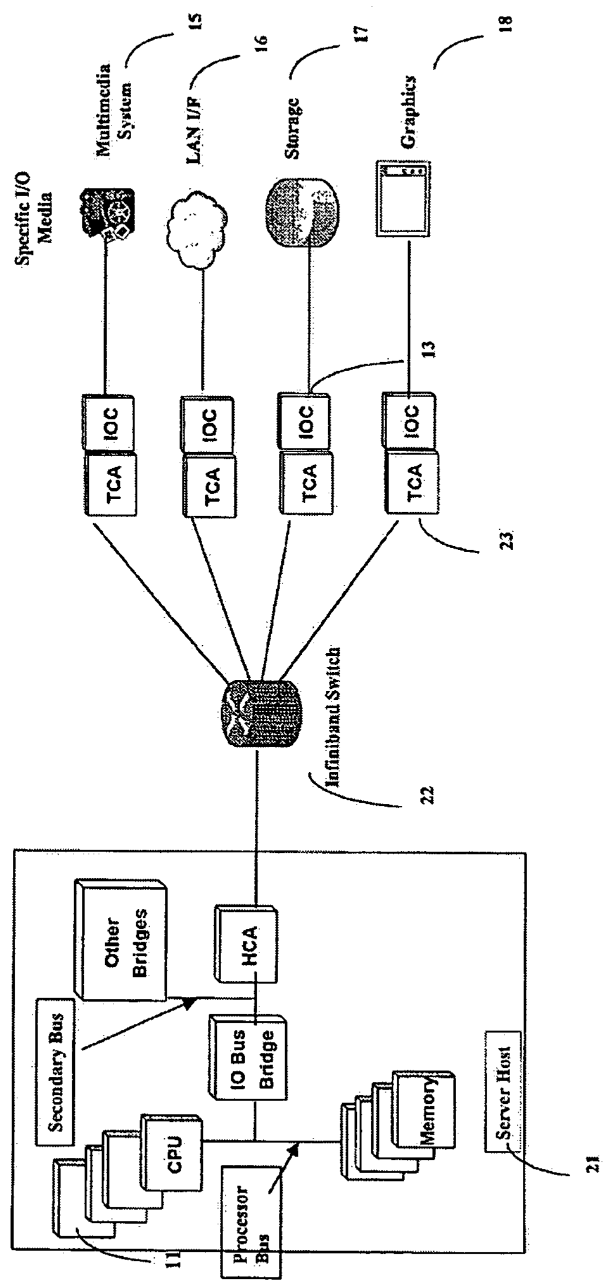
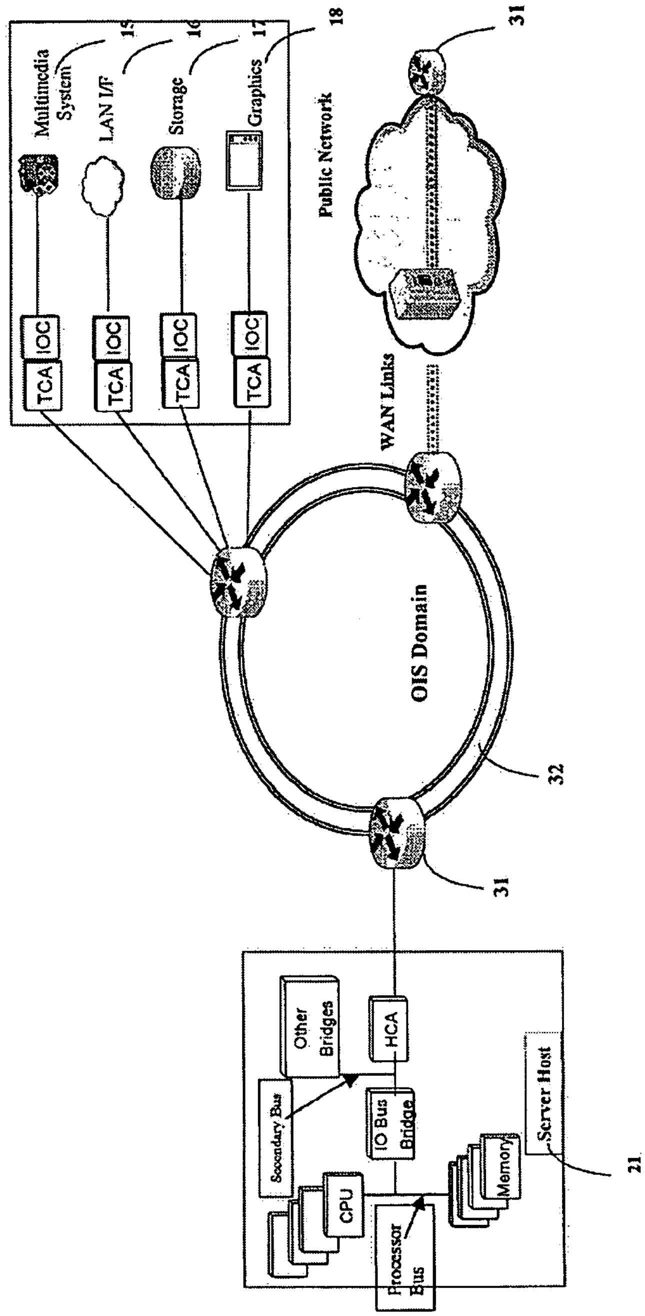


Figure 3. Optical InfiniBand Architecture



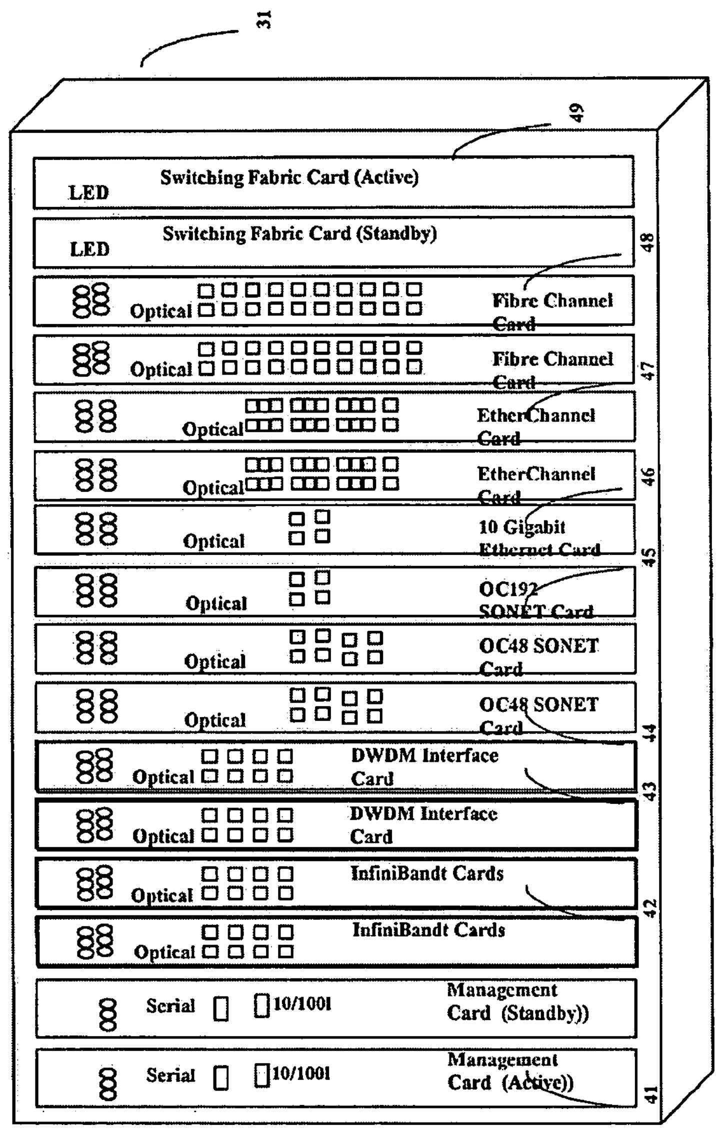


Figure 4. OIR Sample Physical System Layout

Figure 5. OIR Logical Multi-Services System Layout

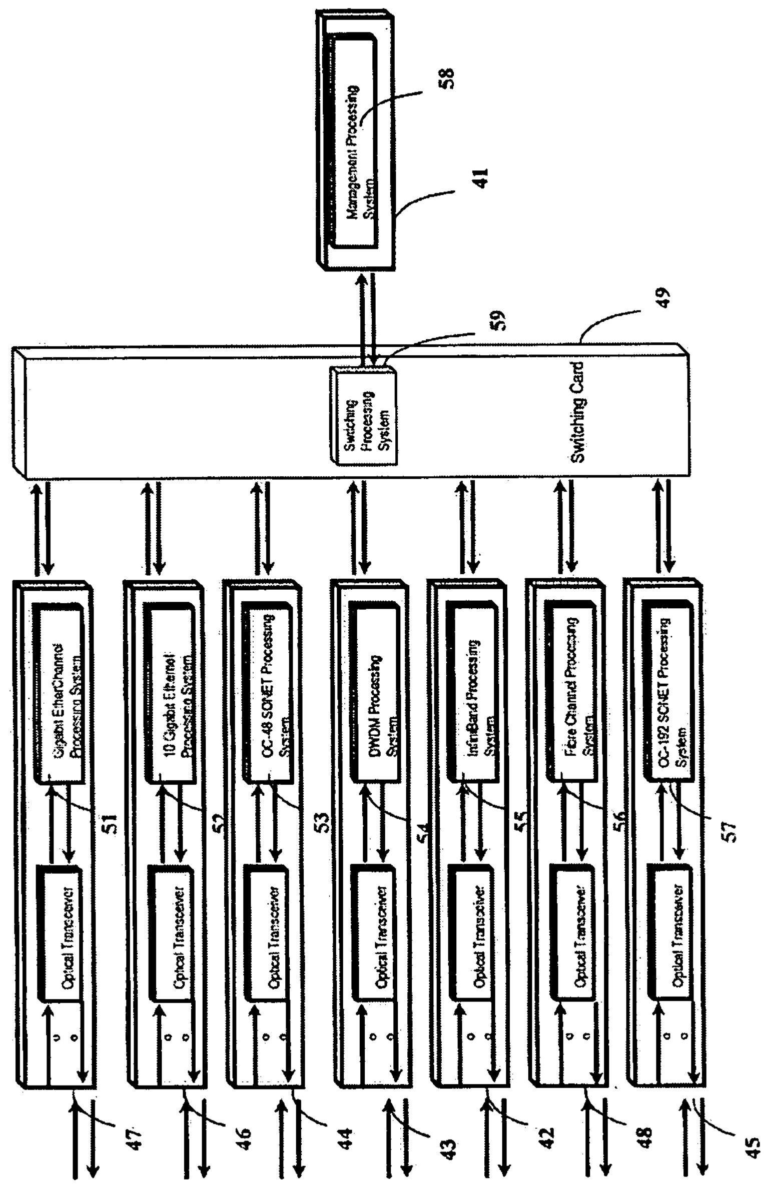


Figure 6. Internetwork SAN Architecture

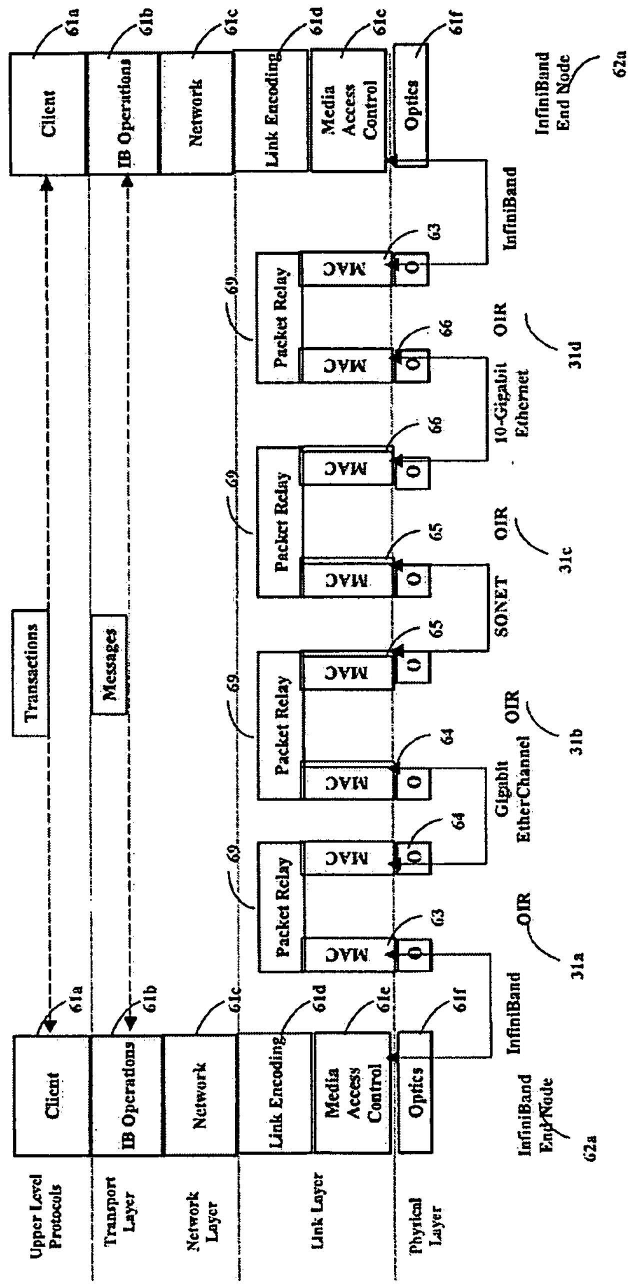


Figure 7: InfiniBand Packet Switching through OIR system

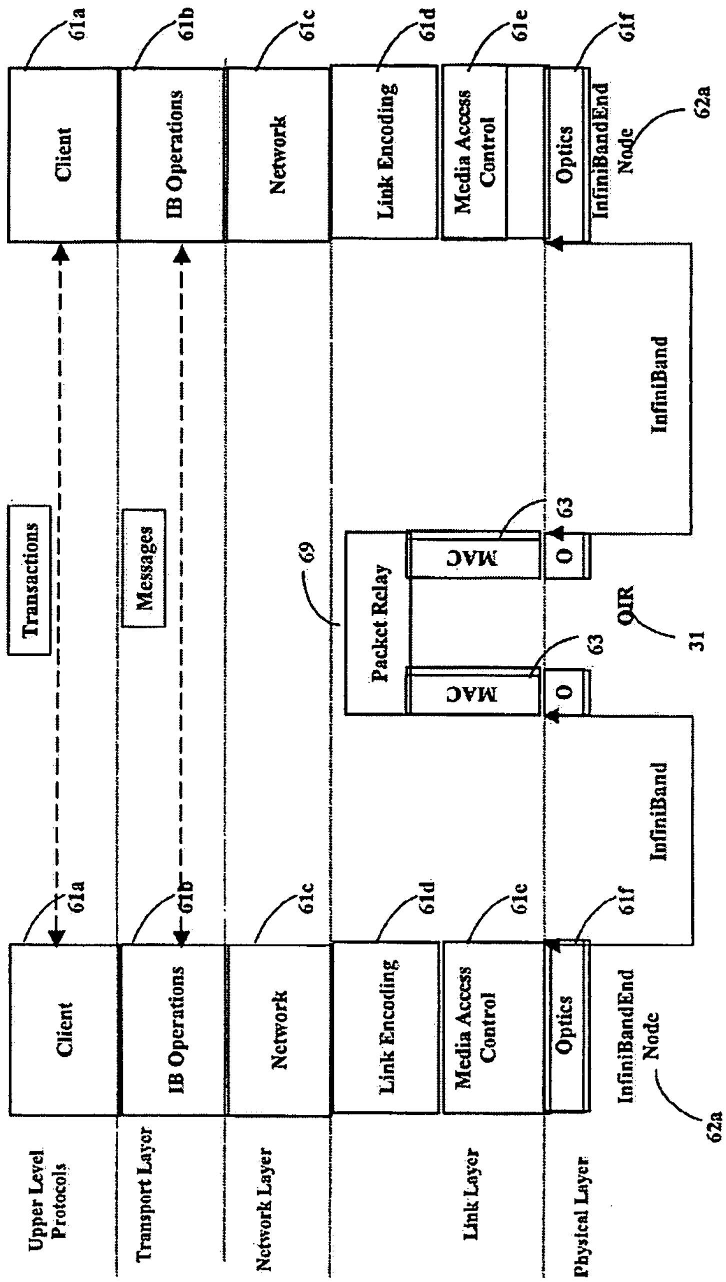


Figure 8. Inter-OIR InfiniBand Packet Switching using Gigabit Ethernet Interfaces

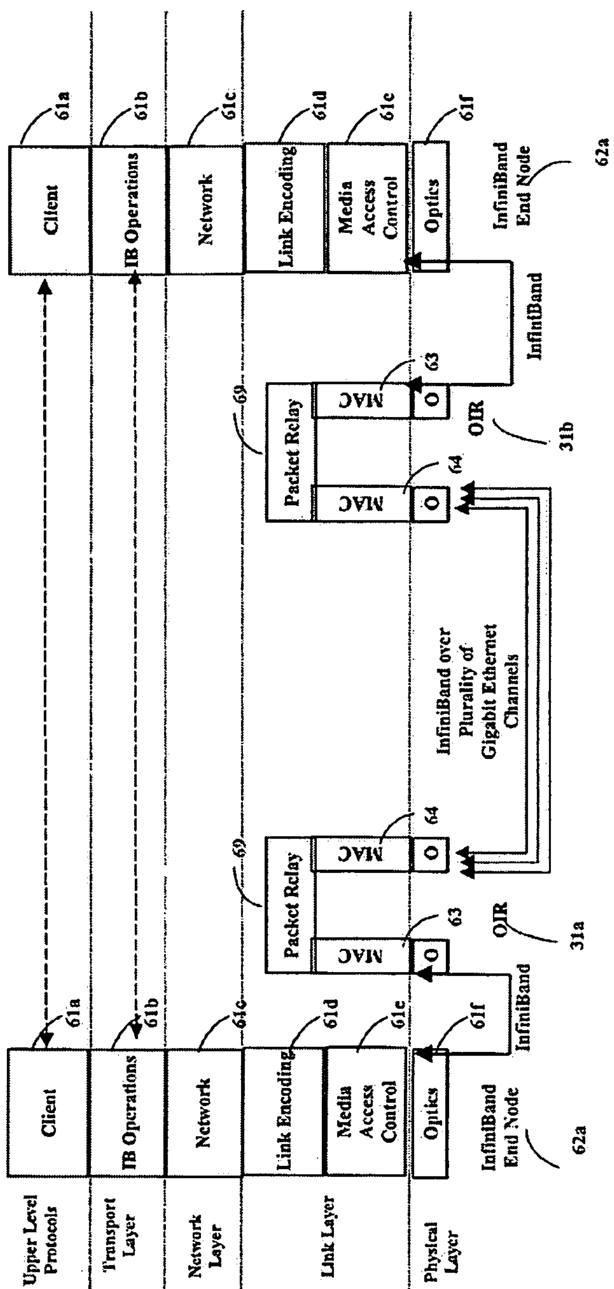


Figure 9. Inter-OIR InfiniBand Packet Switching using SONET Interfaces

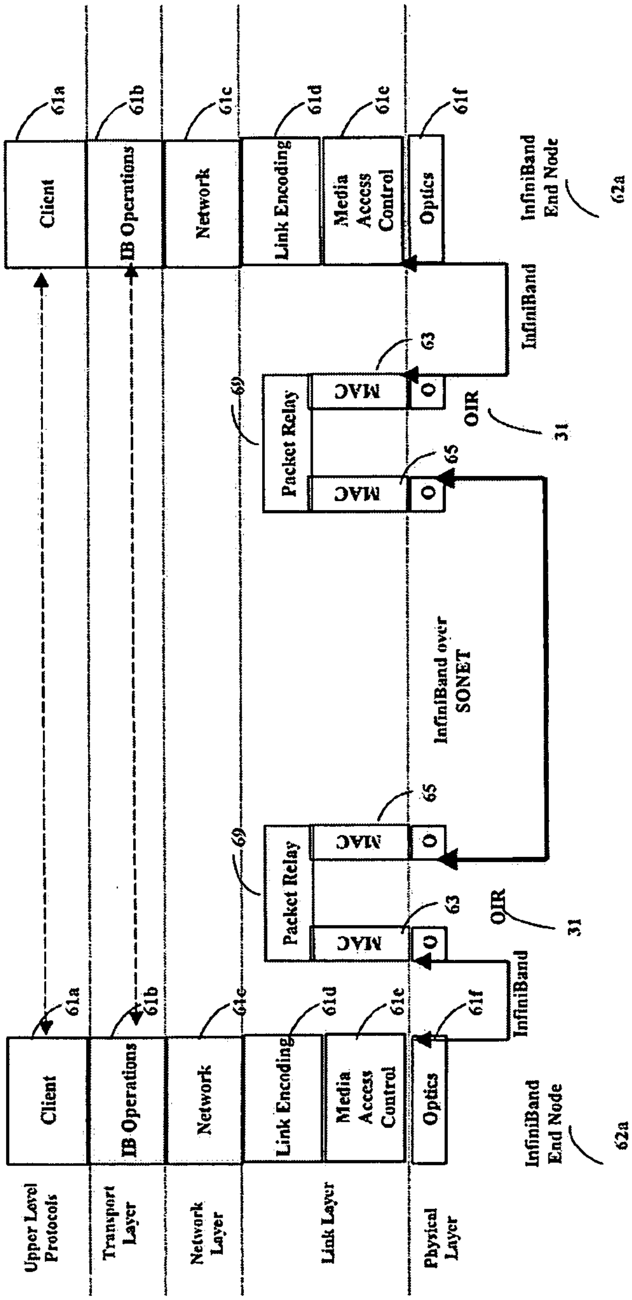


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Figure 10. Inter-OIR InfiniBand Frames Switching using DWDM Interfaces

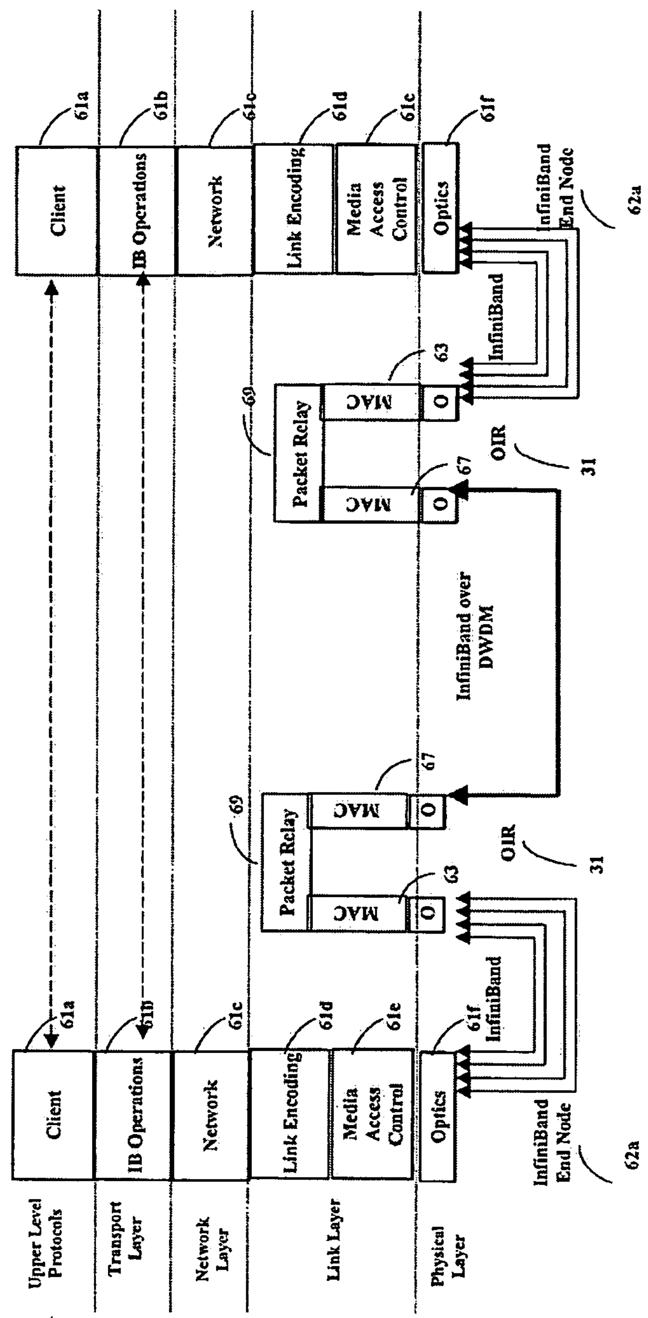

Figure 11. Inter-OIR Fibre Channel Frames Switching using DWDM Interfaces

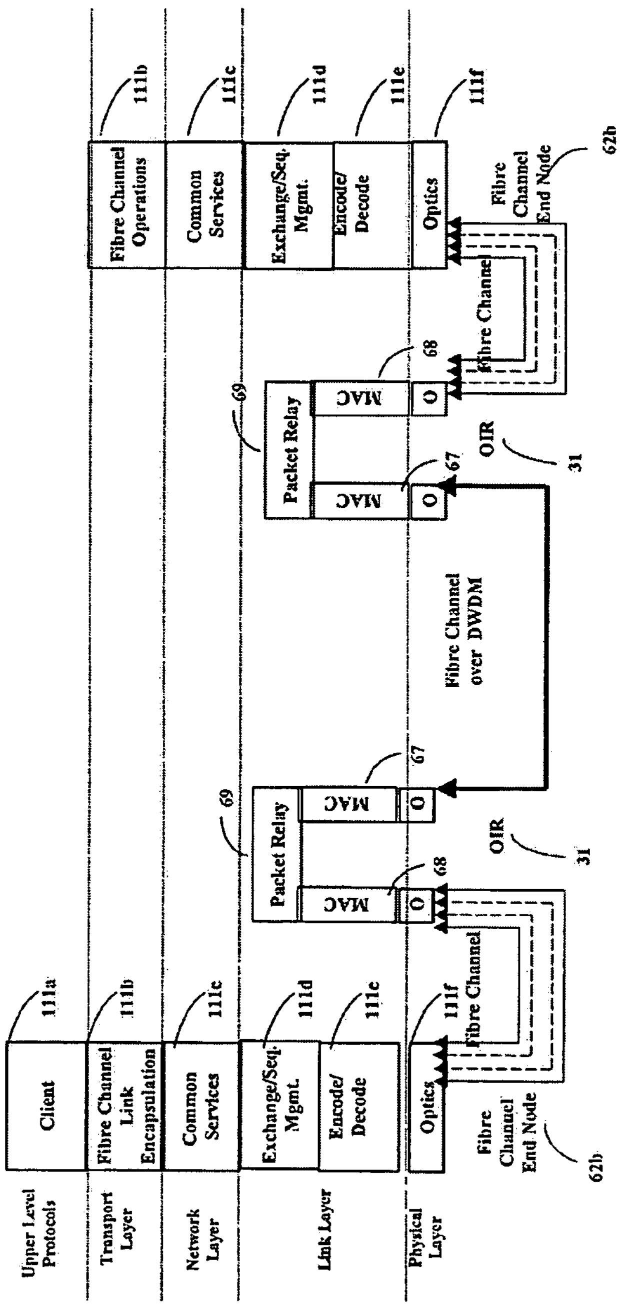

Figure 12. Inter-OIR InfiniBand/Fibre Channel Data Switching using DWDM Interfaces

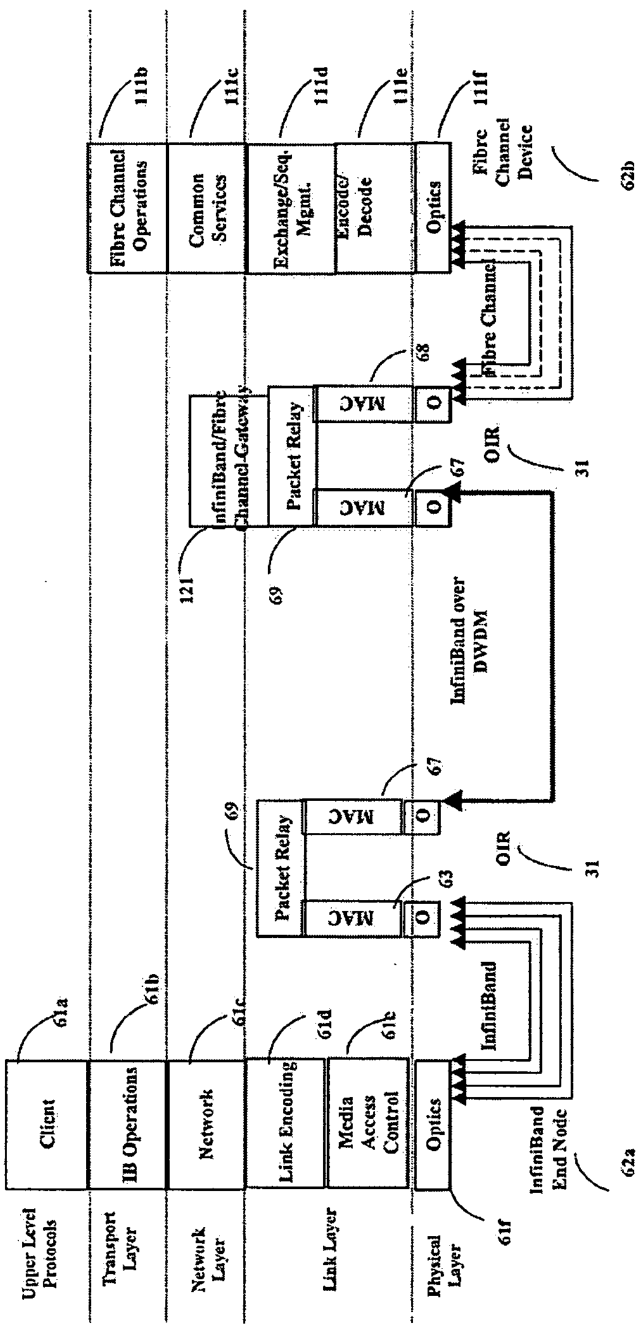

Figure 13. Inter-OIR InfiniBand/iSCSI Data Switching using DWDM Interfaces

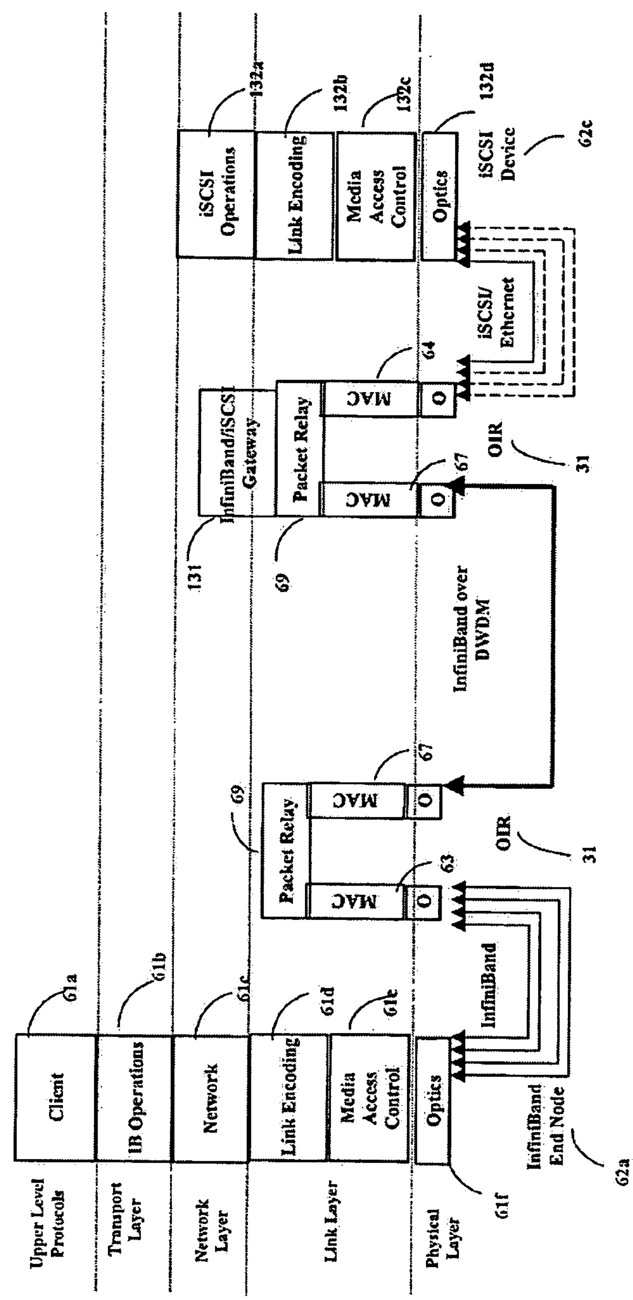

Figure 14. OIR Point-to-Point Packet Format

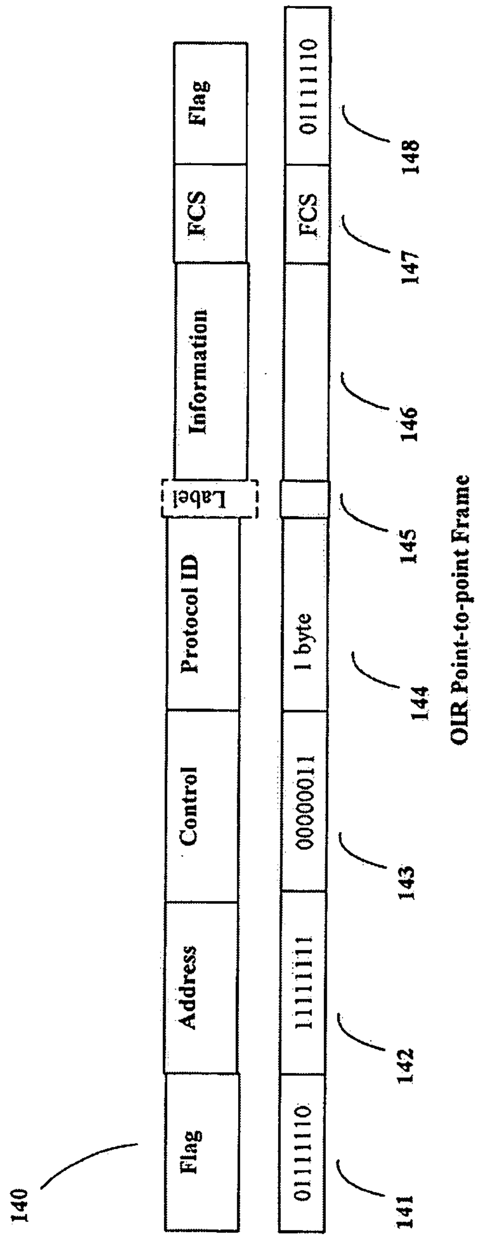

Figure 15. InfiniBand Frame Encapsulated within the OIR Point-to-Point Packet

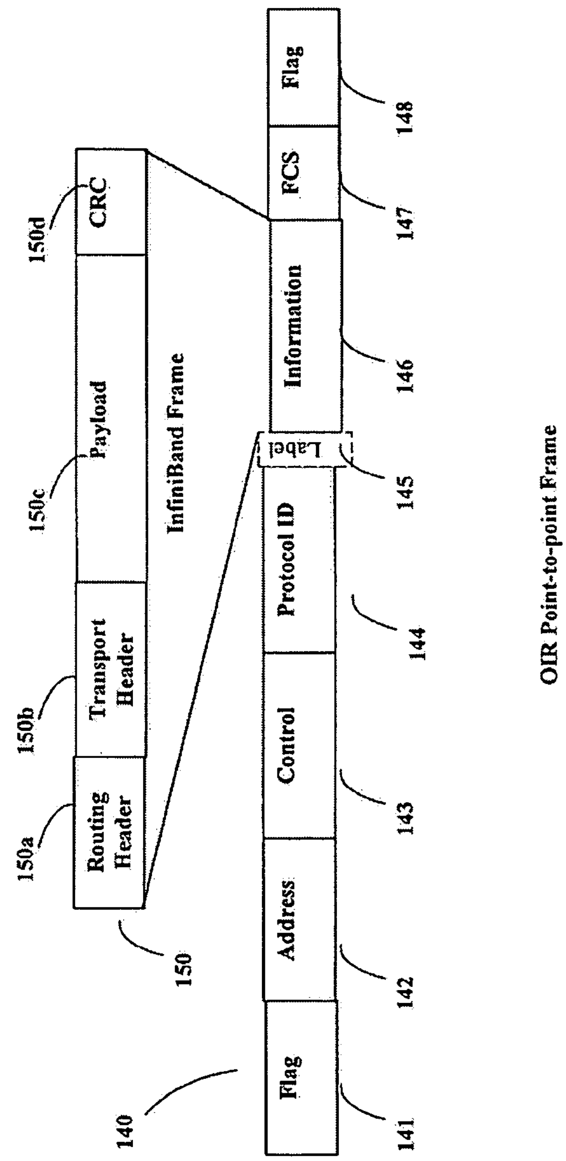

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Figure 16. Fibre Channel Frame Encapsulated within the OIR Point-to-Point Packet

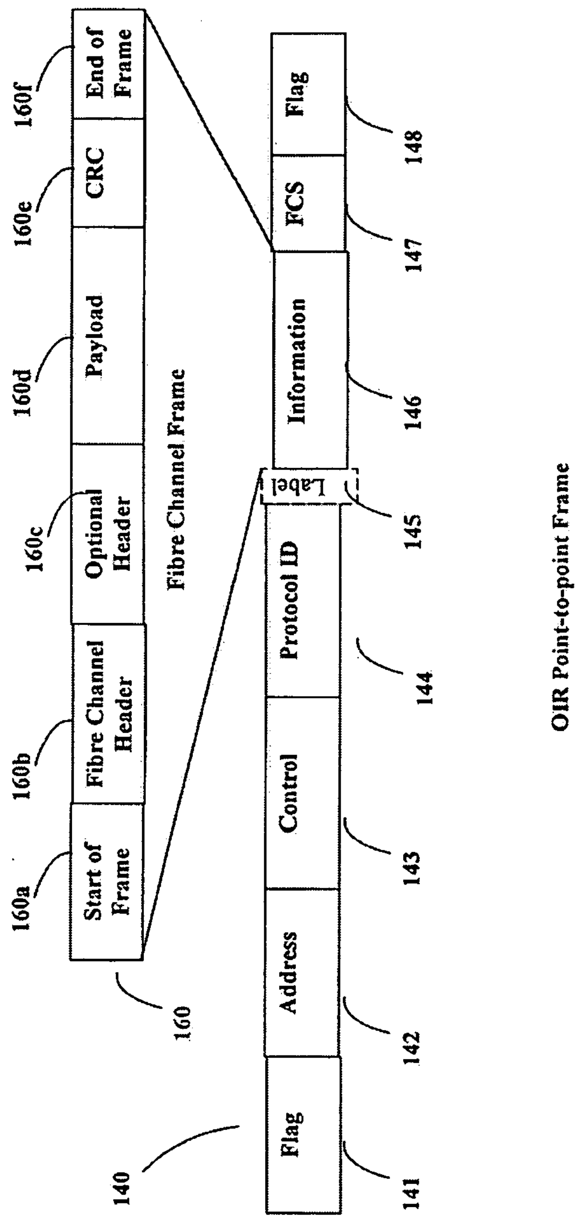
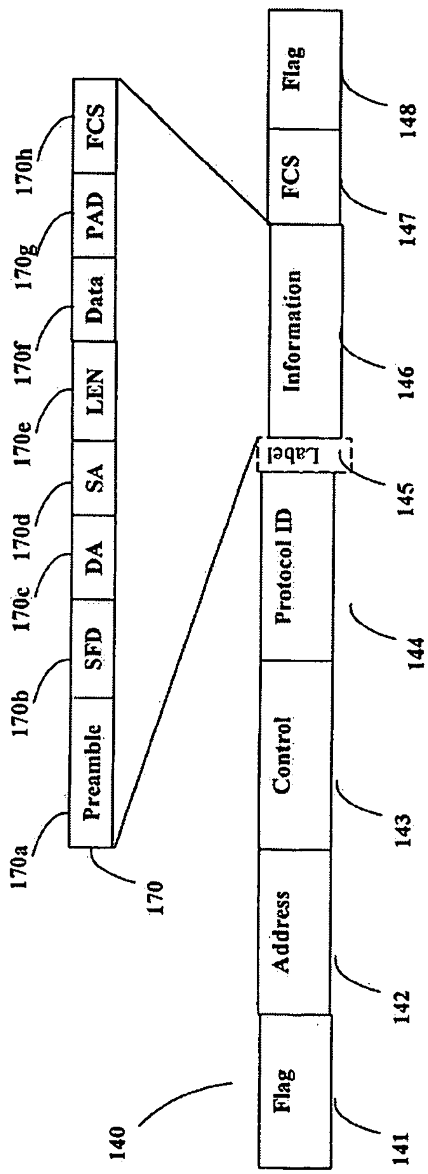
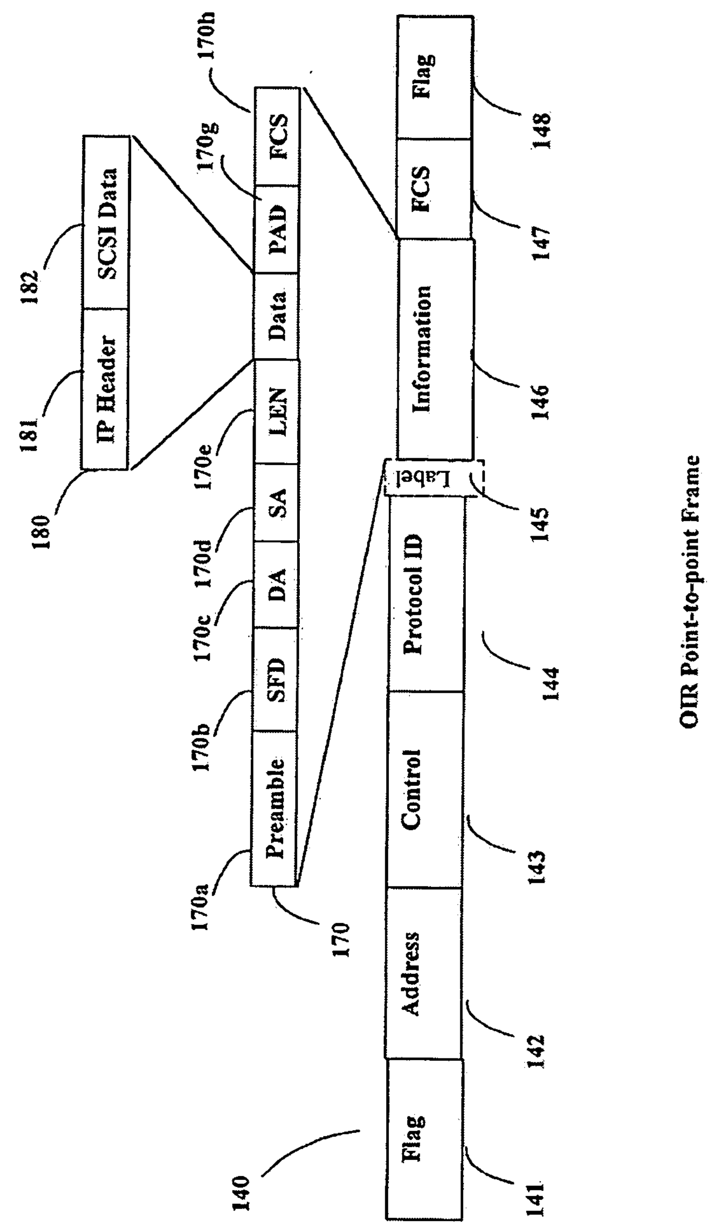


Figure 17. Ethernet Frame Encapsulated within the OIR Point-to-Point Packet



OIR Point-to-point Frame

Figure 18. ISCSI Frame Encapsulated within the OIR Point-to-Point Packet



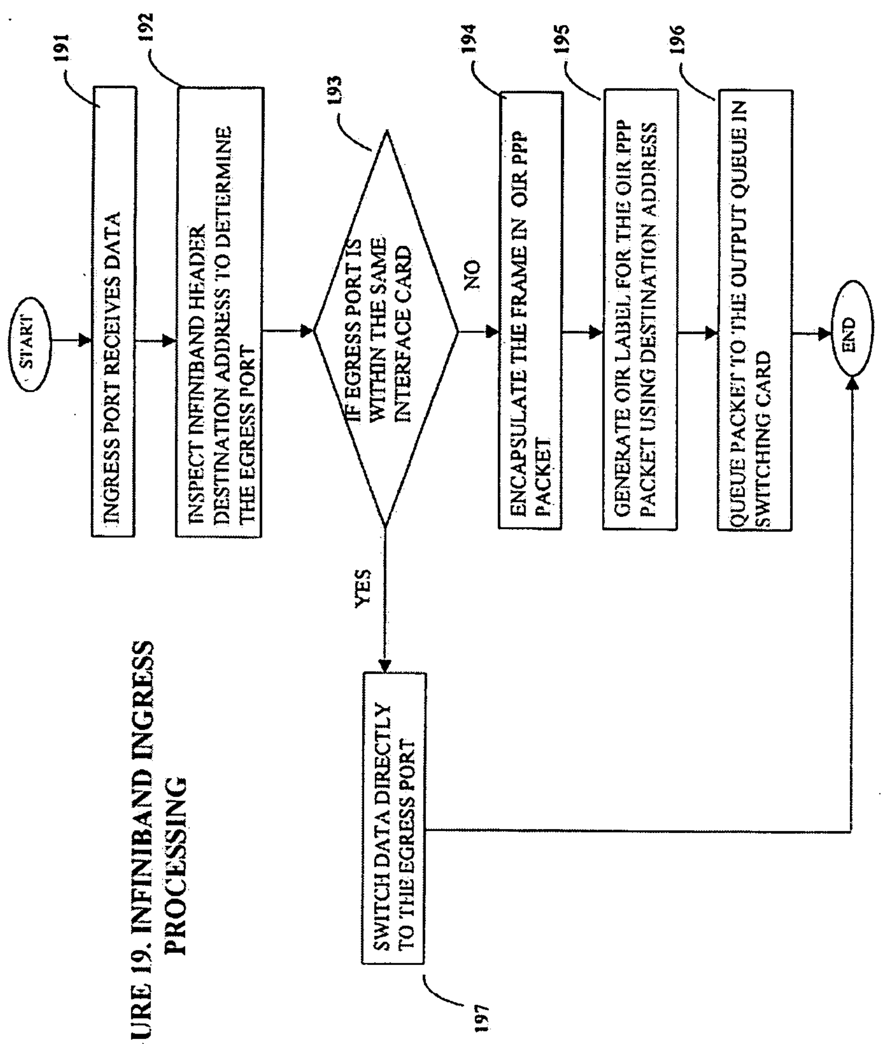
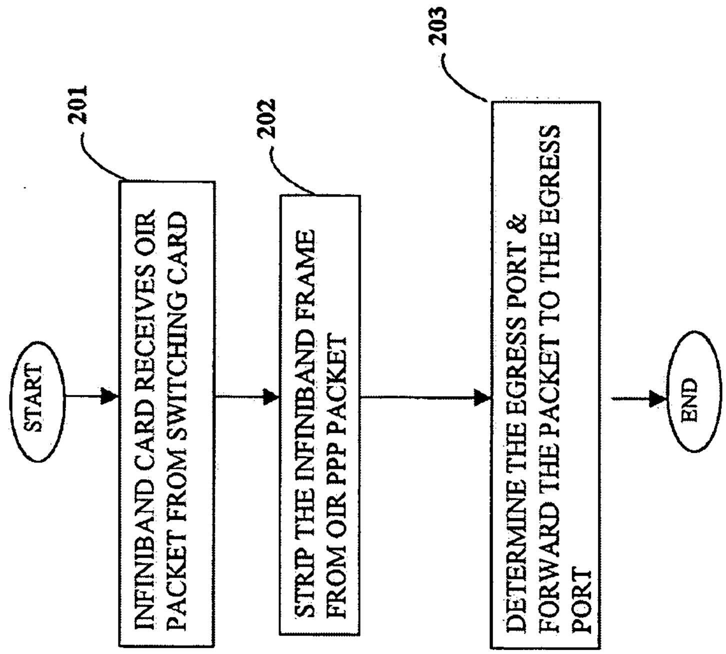


FIGURE 19. INFINIBAND INGRESS PROCESSING

FIGURE 20. INFINIBAND EGRESS PROCESSING



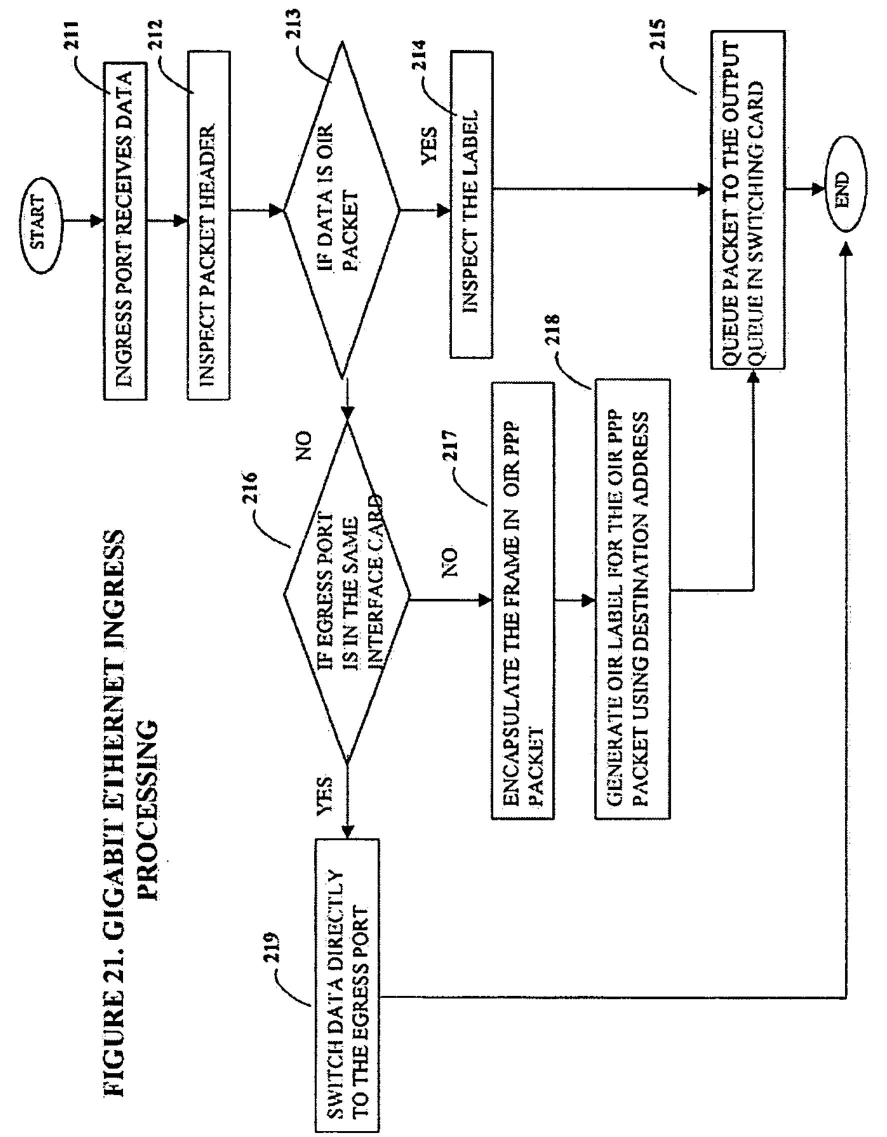


FIGURE 21. GIGABIT ETHERNET INGRESS PROCESSING

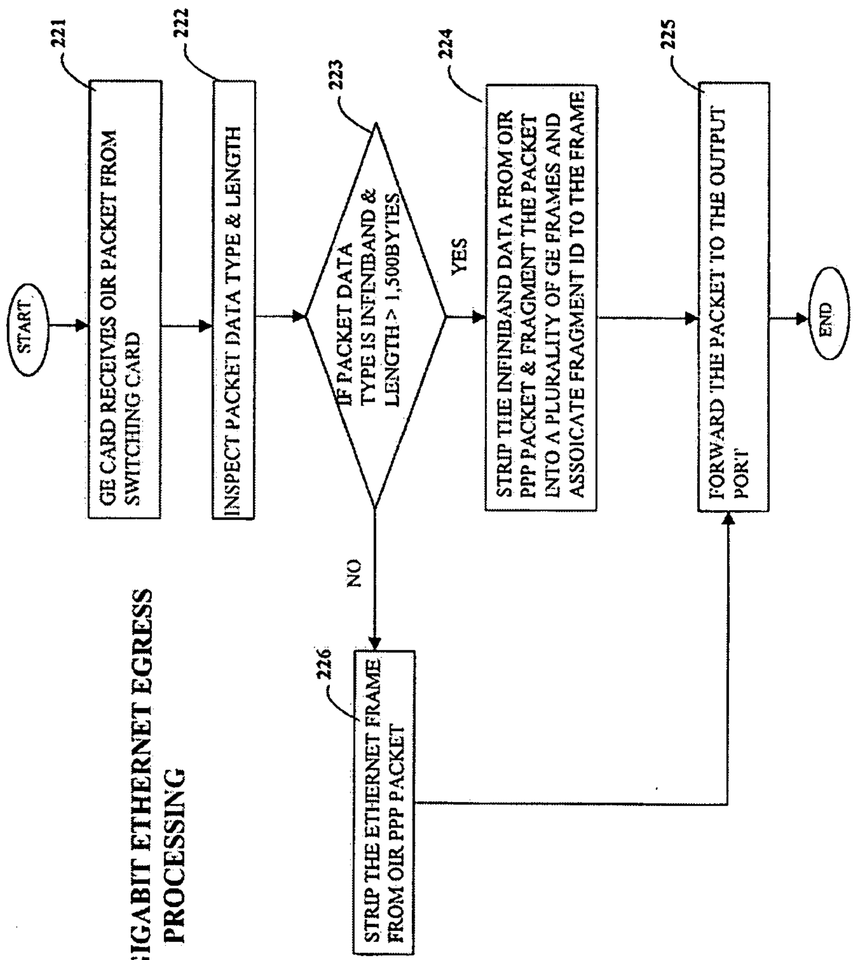


FIGURE 22. GIGABIT ETHERNET EGRESS PROCESSING

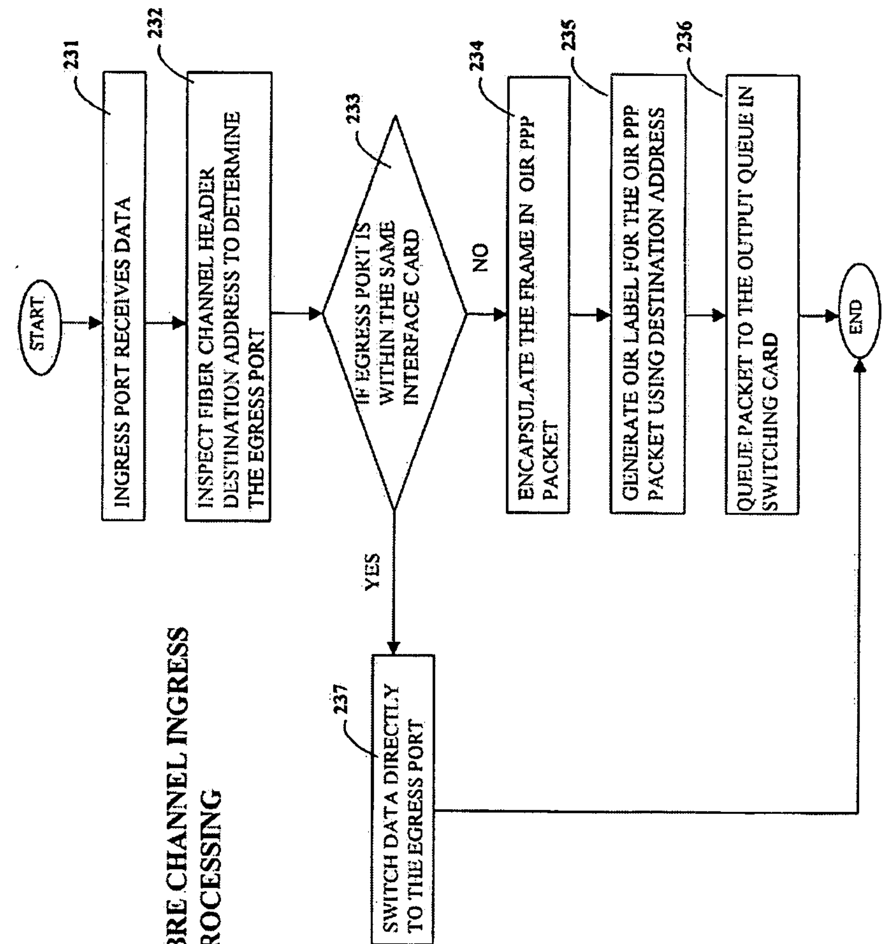
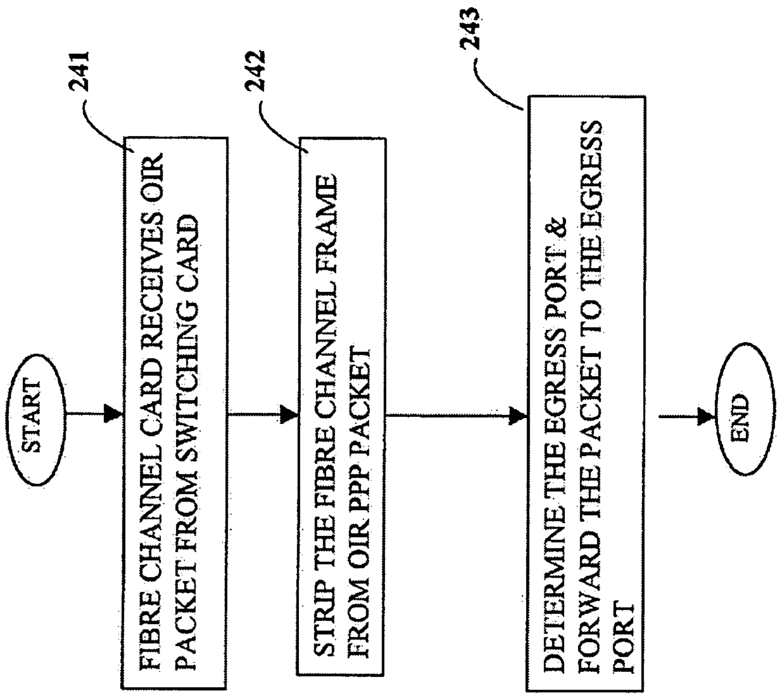


FIGURE 23. FIBRE CHANNEL INGRESS PROCESSING

FIGURE 24. FIBRE CHANNEL EGRESS PROCESSING



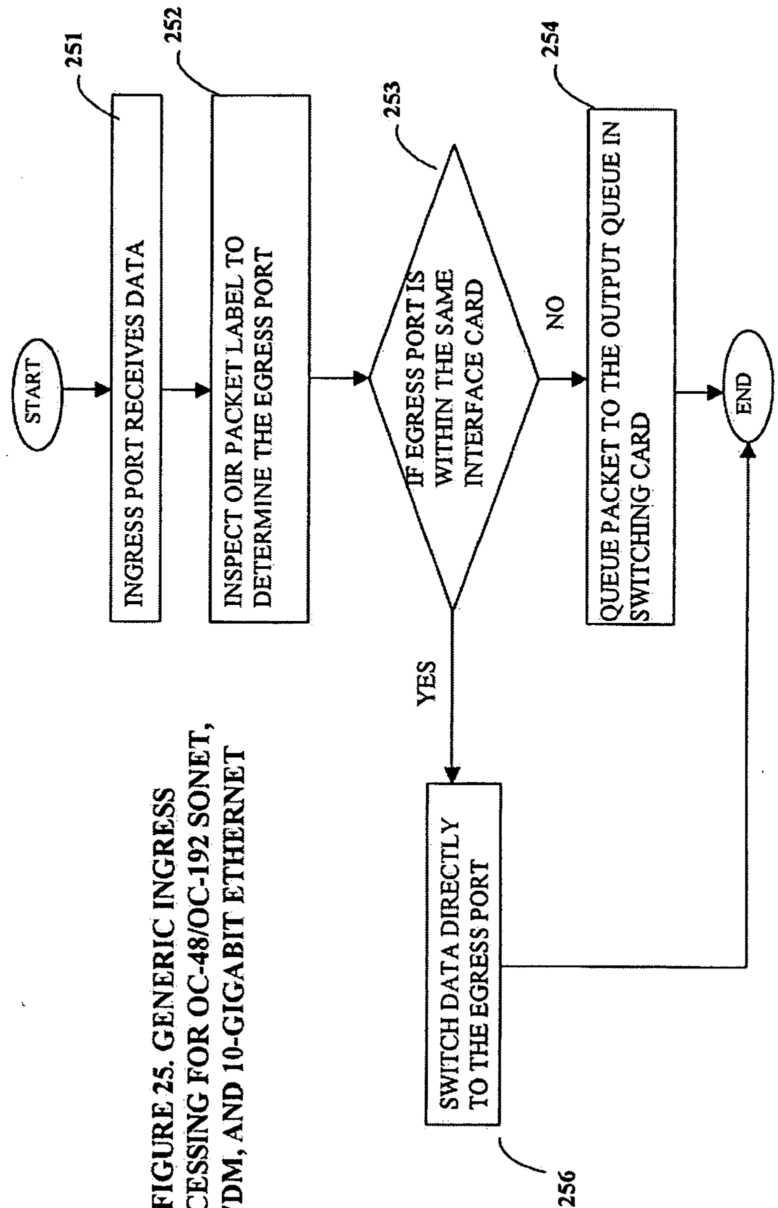
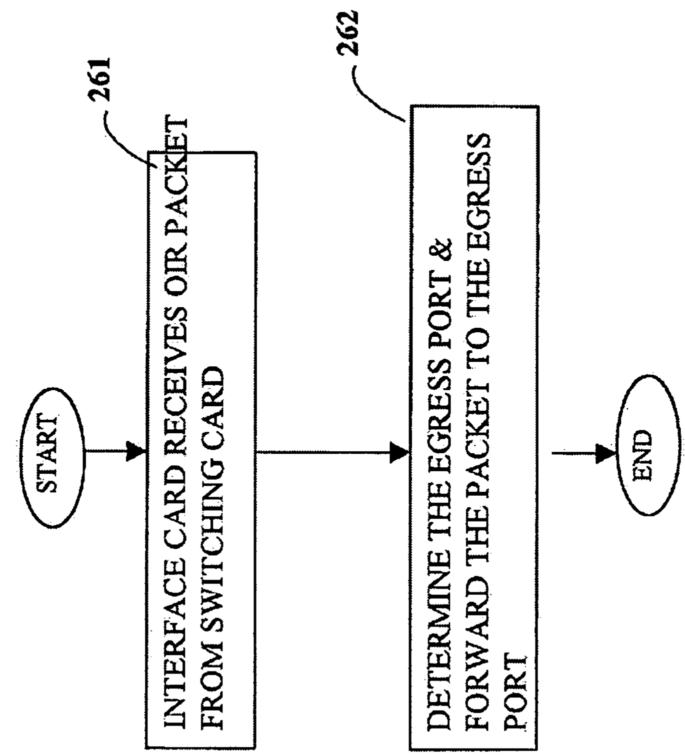


FIGURE 25. GENERIC INGRESS PROCESSING FOR OC-48/OC-192 SONET, DWDM, AND 10-GIGABIT ETHERNET

FIGURE 26. GENERIC INGRESS PROCESSING FOR OC-48/OC-192 SONET, DWDM, AND 10-GIGABIT ETHERNET



MULTI-SERVICE OPTICAL INFINIBAND ROUTER

RELATED APPLICATION

[0001] This application claims the benefit of U.S. Provisional Pat. App. Ser. No. 60/289,274, filed on May 7, 2001. The entire teachings of the above application are incorporated herein by reference.

BACKGROUND

[0002] 1. FIELD OF THE INVENTION

[0003] This invention pertains to a system and method for interconnecting computer devices, networking devices in the local area network, metro area network, wide-area network and system area network using a plurality of computer networking interfaces.

BACKGROUND

[0004] 2. DESCRIPTION OF PRIOR ART

[0005] FIG. 1 illustrates the Traditional System Architecture. The traditional server contains the processing modules 11, the I/O modules 12, and the other interface adapters 13. The I/O is usually based on the SCSI bus or Fibre Channel. The Host usually "owns" the storage 15, which is enclosed with the server enclosure 14. The backup traffic needs to go through the LAN to the server (before getting to another storage device). It has limited scalability (16 devices per bus).

[0006] FIG. 2 illustrates the InfiniBand System Architecture. When all the major servers joined force to define an Infinite Bandwidth I/O bus, they call it InfiniBand. The idea of the InfiniBand architecture is to decouple the Processing Module, called the Server Host 22, and the I/O Module, called the target 23. The Hosts and the Targets are connected through an external switch, called the InfiniBand Switch 22. This switch can be used to connect to multiple InfiniBand nodes, including IB host, IB target, and other IB switches. The architecture is extremely scalable.

[0007] The InfiniBand is good technology if the user does not have to connect to other nodes outside of the InfiniBand System Area Network. The InfiniBand technology has some limitations; the connection between InfiniBand nodes has to be within 100 meters. In addition, there is no specification for connecting to a network beyond the LAN. For example, there is no interoperability definition for InfiniBand to connect to a SONET network. This is what this invention will be doing. Our goal is to remove these kinds of barriers and evolve InfiniBand to become the complete System Area Network solution to the Application Service Providers, the Storage Service Providers, and the large enterprises.

[0008] FIG. 3 illustrates the Optical InfiniBand (IB) Architecture when the Optical InfiniBand Router OIR system 31 is used. With this invention, the Optical InfiniBand Router 32, the IB host 31 can connect to any IB target 34, 35 without any restrictions. The nodes can be thousands of miles away but the nodes will behave like they are connected through a standard I/O bus. This is the power of our invention and that is why this product is so valuable to target customers.

[0009] In addition to transporting InfiniBand data across Local Area Network (LAN), Metro Area Network (MAN), and Wide Area Network (WAN), it will transport storage system related data across the LAN, MAN and WAN. In prior art, SCSI and Fiber Channel technologies are being used for the Storage Area Network (SAN) transport. This invention will also transport any SAN-based frames, including SCSI and Fibre Channel, across the different networking environment.

[0010] InfiniBand structure and functions are described in the literature and is therefore not described in detail here. Among the relevant reference texts are "InfiniBand Architecture Specification, Release 1.0" (ref. 1) and "InfiniBand Technology Prototypes White Paper" (ref. 15).

[0011] Fibre Channel structure and functions are described in the literature and is therefore not described in detail here. Among the relevant reference texts are "The Fibre Channel Consultant-A Comprehensive Introduction" (ref. 7) and "Fibre Channel-The Basics" (ref. 8).

[0012] Small Computer System Interface (SCSI) structure and functions are described in the literature and is therefore not described in detail here. Among the relevant reference texts are "The Book of SCSI: I/O for the New Millennium" (ref. 17) and "Making SCSI Work" (Ref. 18).

[0013] Gigabit Ethernet structure and functions are described in the literature and is therefore not described in detail here. Among the relevant reference texts are "Media Access Control (MAC) Parameters, Physical Layer, Repeater and Management Parameters for 1000 Mb/s Operation," (Ref. 9), and "Gigabit Ethernet-Migrating to High-Bandwidth LANS" (ref. 8).

[0014] SONET structure and functions are described in the literature and is therefore not described in detail here.

[0015] Among the relevant reference texts are "American National Standard for Telecommunications-Synchronous Optical Network (SONET) Payload Mappings," (ref. 5) and "Network Node Interface for the Synchronous Digital hierarchy (SDH)," (ref. 6).

[0016] Dense Wavelength Division Multiplexing (DWDM) technology is described in the literature and is therefore not described in detail here. Among the relevant reference texts are "Web ProForum tutorial:DWDM", (ref. 13) and "Fault Detectability in DWDM Systems: Toward Higher Signal Quality & Reliability" (ref. 16).

[0017] Optical technology and Internet Protocol (IP) technologies are described in the literature and are therefore not described in detail here. Among the relevant reference texts are "The Point-to-Point Protocol (PPP)" (ref. 2), "PPP in HDLC-like Framing" (ref. 3), "PPP over SONET/SDH" (ref. 4), "Optical Communication Networks Multi-Protocol Lambda Switching:Combining MPLS Traffic Engineering Control With Optical Cross-Connects, (ref. 11), "Features and Requirements for The Optical Layer Control Plane" (ref. 12).

[0018] In conclusion, insofar as I am aware, no Optical routers or Storage Area System switches formerly developed provides the multi-services interconnection functions with InfiniBand technology. In addition, insofar as I am aware, no networking systems formerly developed provides the gateway function between the InfiniBand devices and the Storage Area Systems devices or Network Attached Storage devices.

SUMMARY OF THE INVENTION

[0019] Objects and Advantages (over the Prior Art)

[0020] Accordingly, besides the objects and advantages of supporting multiple networking/system services described in my above patent, several objects and advantages of the present invention are:

[0021] To provide a system which can extend the transport of InfiniBand from the 100-meters limited to beyond 100 K meters

[0022] To provide a system which can transport InfiniBand data through Gigabit Ethernet interface between the InfiniBand host or target channel devices.

[0023] To provide a system which can transport InfiniBand data through SONET Add-Drop Multiplexer interface between the InfiniBand host or target channel devices.

[0024] To provide a system which can transport InfiniBand data through DWDM interface between the InfiniBand host or target channel devices.

[0025] To provide a system which can provide a gateway function, which can convert InfiniBand data stream to/from Fibre Channel data stream.

[0026] To provide a system which can provide a gateway function, which can transport InfiniBand data stream to/from Network Attached Storage Filer devices.

[0027] To provide a system which can provide Quality of Service control over the InfiniBand data stream through the OIR network. The OIR network can be comprised of Gigabit Ethernet interface, SONET interfaces, Fibre Channel interfaces and DWDM interfaces.

[0028] Further objects and advantages are to provide a highly reliable, highly available, and highly scalable system, which can be upgradeable to different transport services, including Gigabit Ethernet, SONET, and DWDM. The system is simple to use and inexpensive to manufacture compare to the current Gigabit Ethernet based IP routers, SONET Add-Drop Multiplexers, and DWDM devices. Still further objects and advantages will become apparent from a consideration of the ensuing description and drawings.

Objects (Benefits) to our Customers

[0029] This invention provides our customers with the needed performance and the benefits as follows:

[0030] Simplification

[0031] This invention combines the capability of the InfiniBand, Gigabit Ethernet, SONET, and DWDM into one power router. By providing the multi-services, the customers can easily upgrade and modify the system/network infrastructure without major installation delay or training requirements.

[0032] Providers can greatly simplify service delivery by bringing InfiniBand, Gigabit Ethernet, SONET, DWDM service directly to every midsize to large enterprise and major application service provider (ASP)/Web hosting center.

[0033] Reliability

[0034] The OIR provides redundant hardware platform and traffic paths. By using SONET Automatic Protection Systems or DWDM optical redundant path protection methods, the OIR network is guaranteed to recover from any line/path or hardware failure within 50 milliseconds. The fast failure recovery capability is the key advantage that OIR has over the existing Ethernet based networks.

[0035] Quality of Service (QoS) support

[0036] The customers can configure the user traffic based on their needs. Policy-based Network Management provided with the OIR can manage traffic to each user connection (micro-flows). The OIR supports policies to define deterministic, guaranteed, assured, and shared traffic.

[0037] Scalable Performance

[0038] The OIR can be scaled up using interchangeable line cards. To complement the existing infrastructure, the LAN/SAN/NAS services can be connected to the OIR. Multi-service traffic can be aggregated into high speed Gigabit Ethernet (3 Gbps to 10 Gbps), SONET (2.5 Gbps to 10 Gbps), or multiple wavelength DWDM (up a multitude of gigabits per second) systems.

BRIEF DESCRIPTION OF THE DRAWINGS

[0039] FIG. 1. is a block diagram illustrating a traditional server system architecture.

[0040] FIG. 2. is a block diagram illustrating the InfiniBand Architecture.

[0041] FIG. 3. is a block diagram illustrating the Optical InfiniBand Routing (OIR) system.

[0042] FIG. 4. is a block diagram illustrating an OIR sample system layout.

[0043] FIG. 5. is a block diagram illustrating the OIR Logical Multi-Services System Layout.

[0044] FIG. 6. is a block diagram illustrating a method for inter-networking System Area Network (SAN) switching using OIR technology.

[0045] FIG. 7. is a block diagram illustrating a method for InfiniBand Packet switching through the OIR system.

[0046] FIG. 8. is a block diagram illustrating a method for Inter-OIR InfiniBand Packet switching using Gigabit Ethernet Interfaces.

[0047] FIG. 9. is a block diagram illustrating a method for Inter-OIR InfiniBand Packet switching using SONET Interfaces.

[0048] FIG. 10. is a block diagram illustrating a method for Inter-OIR InfiniBand Packet switching using DWDM Interfaces.

[0049] FIG. 11. is a block diagram illustrating a method for Inter-OIR Fibre Channel Data switching using DWDM Interfaces.

[0050] FIG. 12. is a block diagram illustrating a method for Inter-OIR InfiniBand/Fibre Channel Data switching using DWDM Interfaces.

[0051] FIG. 13. is a block diagram illustrating a method for Inter-OIR InfiniBand/iSCSI Data switching using DWDM Interfaces.

[0052] FIG. 14. is a block diagram illustrating Packet Format for the OIR system.

[0053] FIG. 15. is a block diagram illustrating the InfiniBand Frame encapsulated within the OIR Packet.

[0054] FIG. 16. is a block diagram illustrating the Fibre Channel Frame encapsulated within the OIR Packet.

[0055] FIG. 17. is a block diagram illustrating the Ethernet Frame encapsulated within the OIR Packet.

[0056] FIG. 18. is a block diagram illustrating the iSCSI Frame encapsulated within the OIR Packet.

[0057] FIG. 19. is a block diagram illustrating the InfiniBand Ingress Processing

[0058] FIG 20. is a block diagram illustrating the InfiniBand Egress Processing

[0059] FIG 21. is a block diagram illustrating the Gigabit Ethernet Ingress Processing

[0060] FIG 22. is a block diagram illustrating the Gigabit Ethernet Egress Processing

[0061] FIG 23. is a block diagram illustrating the Fibre Channel Ingress Processing

[0062] FIG 24. is a block diagram illustrating the Fibre Channel Egress Processing

[0063] FIG 25. is a block diagram illustrating the Generic Ingress Processing for OC-48 SONET interface, OC-192 SONET interface, DWDM interface, and 10-Gigabit Ethernet interface.

[0064] FIG 26. is a block diagram illustrating the Generic Egress Processing for OC-48 SONET interface, OC-192 SONET interface.

Reference Numerals In Drawings

[0065] 11 Processing Module

[0066] 12 PCI Bus Interface

[0067] 13 Input/Output Controller

[0068] 14 Traditional Server (Enclosure)

[0069] 15 MultiMedia Device

[0070] 16 Local Area Network

[0071] 17 Storage (Disks, Tapes, Flash Memory)

[0072] 18 Graphics Device

[0073] 21 InfiniBand Server Host

[0074] 22 InfiniBand Switch

[0075] 23 InfiniBand Target Channel Adapter

[0076] 31 Optical InfiniBand Router (OIR System)

[0077] 31*a* Originating OIR System (same as 31-OIR system with infiniBand interface support)

[0078] 31*b* Intermediate OIR System (same as 31-OIR system with Gigabit Ethernet interface support)

[0079] 31*c* Originating OIR System (same as 31-OIR system with SONET interface support)

[0080] 31*d* Destined OIR System (same as 31-OIR system with DWDM interface support)

[0081] 32 2 Fiber/4 Fiber SONET/DWDM Ring Network

[0082] 41 Management Card (Active/Standby)

[0083] 42 InfiniBand Interface Card

[0084] 43 DWDM Interface Card

[0085] 44 OC-48 SONET Card

[0086] 45 OC-192 SONET Card

[0087] 46 10-Gigabit Ethernet Card

[0088] 47 Ether-Channel Interface Card (1-Gigabit Ethernet Interface Card)

[0089] 48 Fiber Channel Interface Card

[0090] 49 Switching Fabric Card (Active/Standby)

[0091] 51 Gigabit Ether-Channel Processing System

[0092] 52 10-Gigabit Ethernet Processing System

[0093] 53 OC-48 SONET Processing System

[0094] 54 DWDM Processing System

[0095] 55 InfiniBand Processing System

[0096] 56 Fibre Channel Processing System

[0097] 57 OC-192 SONET Processing System

[0098] 58 Management Processing System

[0099] 59 Switching Processing System

[0100] 61*a* Client Applications/ Upper Level Protocols

[0101] 61*b* InfiniBand Operations/ Transport Layer

[0102] 61*c* Network Layer

[0103] 61*d* Link Encoding within Link Layer

[0104] 61*e* Media Access Control within Link Layer

[0105] 61*f* Optics Fiber(O)/ Physical Layer

[0106] 62*a* InfiniBand Device/End Node

[0107] 62*b* FibreChannel Device/End Node

[0108] 62*c* iSCSI Device/End Node

[0109] 63 InfiniBand Interface on OIR System

[0110] 64 Gigabit Ether-Channel Interface on OIR System

[0111] 65 SONET Interface on OIR System

[0112] 66 10-Gigabit Ethernet Interface on OIR System

[0113] 67 DWDM Interface on OIR System

[0114] 68 Fibre Channel Interface OIR System

[0115] 69 Switching Processing System on OIR System (performing packet relay)

[0116] 111*a* Generic Client Applications/ Upper Level Protocols

[0117] 111*b* Fibre Channel Link Encapsulation

[0118] 111c Fibre Channel Common Services

[0119] 111*d* Fibre Channel Exchange and Sequence Management

[0120] 111*e* Fibre Channel 8*b*/10*b* Encode/Decode and Link Control

[0121] 111*f* Fibre Channel Optics Fiber(O)/ Physical Layer

[0122] 121 InfiniBand/Fibre Channel Gateway

[0123] 131 InfiniBand/iSCSI Gateway

[0124] 132*a* iSCSI Operation

[0125] 132*b* Ethernet Link Encoding

[0126] 132*c* Ethernet Media Access Control

[0127] 132*d* Ethernet Optics Fiber(O)/ Physical Layer

[0128] 140 OIR System Point-to-Point Format

[0129] 141 Frame Start Flag Field within OIR Point-to-Point Frame

[0130] 142 Address Field within OIR Point-to-Point Frame

[0131] 143 Control Field within OIR Point-to-Point Frame

[0132] 144 Protocol Identifier Field within OIR Point-to-Point Fame

[0133] 145 Label Field within OIR Point-to-Point Frame

[0134] 146 Information Field within OIR Point-to-Point Frame (Data Payload)

[0135] 147 Frame Check Sequence Field within OIR Point-to-Point Frame

[0136] 148 Frame End Flag Field within OIR Point-to-Point Frame

[0137] 150 InfiniBand Frame Format

[0138] 150*a* Routing Header Field within InfiniBand Frame

[0139] 150*b* Transport Header Field within InfiniBand Frame

[0140] 150*c* Payload Field within InfiniBand Frame

[0141] 150*d* CRC Field within InfiniBand Frame

[0142] 160 Fibre Channel Frame

[0143] 160*a* Start of Frame Field within Fibre Channel Frame

[0144] 160*b* Fibre Channel Header Field within Fibre Channel Frame

[0145] 160*c* Optional Header Field within Fibre Channel Frame

[0146] 160*d* Payload Field within Fibre Channel Frame

[0147] 160*e* CRC Field within Fibre Channel Frame

[0148] 160*f* Start of Frame Field within Fibre Channel Frame

[0149] 170 Ethernet Frame

[0150] 170*a* Preamble Field within Ethernet Frame

[0151] 170*b* Start Frame Delimiter (SFD) Field within Ethernet Frame

[0152] 170c Destination Address (DA) Field within Ethernet Frame

[0153] 170*d* Source Address (SA) Field within Ethernet Frame

[0154] 170*e* Length (LEN) Field within Ethernet Frame

[0155] 170*f* Data Field within Ethernet Frame

[0156] 170*g* Padding Field within Ethernet Frame

[0157] 170*h* Frame Check Sequence Field within Ethernet Frame

[0158] 180 Internet Protocol Packet Format

[0159] 181 Internet Protocol Header

[0160] 182 SCSI Data

[0161] 191-262 Labels for the Data Flow Diagrams

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0162] The invention, an InfiniBand Optical Router, has the capabilities to transport and route data packets to and from the following devices:

[0163] InfiniBand Host Server device

[0164] InfiniBand Target Channel device

[0165] SONET Add-Drop Multiplexing device

[0166] DWDM device

[0167] Gigabit Ethernet-based IP Switching device

[0168] Gigabit Ethernet-based IP Routing device

[0169] Fiber Channel Host Channel Adapter device

[0170] ISCSI device

DRAWINGS

FIGS. 4 and 5—PREFERRED EMBODIMENT

[0171] FIG. 4 illustrates a sample physical system layout and FIG. 5 illustrates the logical system layout of the Optical InfiniBand Routing (OIR) device 31. Each type of line card will contain different layer 1 and layer 2 hardware components. For example, the OC-48 SONET cards 44 will have an optical transceiver and SONET framer while the

Ethernet cards 47 will have Ethernet transceivers with MAC/GMAC interface. The OIR device contains the following:

[0172] Management Card(s) 41—are responsible for the management and control of the OIR system. In addition to the OIR management functions, the Management Processing System 58 can be enhanced to perform higher-level application functions as needed.

[0173] InfiniBand Interface Card(s) 42—are responsible for interfacing with the InfiniBand Host and Target Channel devices. The InfiniBand Processing System 55 processes the InfiniBand data and encapsulates the InfiniBand payload into the OIR Point-to-Point Packet format 140.

[0174] DWDM Interface Card(s) 43—are responsible for interfacing with upstream or downstream DWDM system. The function of the DWDM Processing system 54 is mainly for multiplexing and de-multiplexing lower speed data packets onto the high-speed DWDM optical transport.

[0175] OC-48 SONET Card(s) 44—are responsible for interfacing with upstream or downstream OC-48 SONET system. The function of the SONET Processing system 53 is mainly for transporting SONET payload between SONET capable devices, including OIR system 31. Traffic from the SONET card 44 is de-multiplexed, de-framed and packet extracted before sending to the Network Processor for packet processing. The SONET Processing System 53 will perform path, line, and section overhead processing and pointer alignment processing.

[0176] OC-192 SONET Card(s) 45—are responsible for interfacing with upstream or downstream OC-192 SONET system. The function of the SONET Processing system 57 is mainly for transporting SONET payload between SONET capable devices, including OIR system 31, and multiplexing and de-multiplexing lower speed data packet onto the high-speed OC-192 SONET optical transport.

[0177] Gigabit Ether-Channel Card(s) 47—are responsible for interfacing with upstream or downstream Gigabit Ethernet system or OIR. Gigabit Ether-Channel Interfaces 47. The Gigabit Ethernet card will support the GBIC interface to allow for serial data transmission over fiber optic or coaxial cable interfaces. The Gigabit Ether-Channel Processing System 51 processes the Ethernet data and encapsulates the Ethernet payload into the OIR Point-to-Point Packet format 140. It also performs fragmentation and de-fragmentation function on InfiniBand frame or other payload that has large frame size than Ethernet frame. The fragmented frames are forwarded to the destination within the OIR system 31 by a plurality of Gigabit Ethernet frames. The fragmented frames are reassembled (or de-fragmented) at the destination Gigabit Ether-Channel Interface 47 of the OIR system 31.

[0178] When InfiniBand traffic is transported through the OIR system 31 to another OIR system 31 within the OIR network, the Gigabit Ether-Channel Processing system 51 will activate the Ether-Channel processing function to transport the InfiniBand data packet using a plurality of Gigabit Ethernet channels. The Gigabit Ethernet Processing system 51 is responsible for fragmenting the InfiniBand data frame into smaller Ethernet packets and de-fragmenting the Ethernet packets into the original InfiniBand data frame.

[0179] When Fibre Channel traffic is transported through OIR system 31 to another OIR system 31 within the OIR network, the Gigabit Ether-Channel Processing system 51 will activate the Ether-Channel processing function to transport the Fibre Channel data packet using a plurality of Gigabit Ethernet channels. The Gigabit Ethernet Processing system 51 is responsible for fragmenting the Fibre Channel data frame into smaller Ethernet packets and de-fragmenting the Ethernet packets into the original Fibre Channel data frame.

[0180] When IP traffic is transported through the OIR network, no special Ether-Channel function will be used. The IP traffic will be packeted into the OIR packet format to be transported between OIR systems 31.

[0181] When iSCSI traffic is transported through the OIR network, no special Ether-Channel function will be used. The iSCSI traffic will be encapsulated within the IP payload, and then the IP payload will be packeted into the OIR packet format to be transported between OIR systems 31.

[0182] 10-Gigabit Ethernet Interface Card(s) 46—are responsible for interfacing with upstream or downstream 10-Gigabit Ethernet systems. The function of the 10-Gigabit Ethernet Processing System 52 is mainly for transporting 10-Gigabit Ethernet Frames between 10-Gigabit Ethernet capable devices, including OIR system 31, and multiplexing and de-multiplexing lower speed data packets onto the high-speed 10-Gigabit Ethernet optical transport.

[0183] Fibre Channel Interface Card(s) 48—are responsible for interfacing with the Fibre Channel capable Channel devices. The Fibre Channel Processing System 56 processes the Fibre Channel data and encapsulates the Fibre Channel frames into the OIR Point-to-Point Packet Format 140.

[0184] Switching Fabric Cards(s) 49—are responsible for performing arbitration amongst packets from different input sources. Based on the Quality of Service policies, the Switching Processing System 59 will schedule the packets to be transported to different output ports of different interface cards.

OPERATIONS—FIGS. 6, 7,8,9,10,11,12,13

[0185] FIG. 6 is a block diagram illustrating how InfiniBand (IB) data can be transported through the OIR system 31 to other InfiniBand devices. As is known in the prior art, the Open System Interconnection ("OSI") model is used to describe computer network. The OSI model consists of seven layers: physical, link, network, transport, session, presentation, and application. Since the OIR is a routing device that focuses on the network and link layer, the other 5 layers will not be discussed in detail.

[0186] In a normal InfiniBand operation, the client application 61*a* at the originating end nodes 62*a* invokes an IB operation 61*b* on an InfiniBand capable device, an Infini-

Band Host Channel Adapter. The Host Channel Adapter interprets the Work Queue Elements (WQE), creates a request packet with the appropriate destination address. The destination address is composed of two unicast identifiers—a Global Identifier (GID) and Local Identifier (LID). The GID is used by the network layer 61c for routing the packets between subnets. The LID is used by the Link Layer 61d to switch packets within a subnet.

[0187] The physical layer 61f is responsible for establishing physical link and delivering received control and data bytes to the link layer 61d, 61e. The Link Layer 61d, 61e provides supports for addressing, buffering, flow control, error detection and switching. The InfiniBand request packet is sent from the originating end node 31a to the OIR InfiniBand Interface Card 42 of an OIR system 31b.

[0188] The OIR InfiniBand Processing System 55 encapsulates the InfiniBand packet into the OIR Packet payload 150c. In addition, it will generate an OIR label 145, which is used by the OIR system 31 to route the InfiniBand packet to the destination end node 31b.

[0189] In FIG. 6, the originating OIR node 31a and intermediate OIR node 31b are interfacing using Gigabit Ethernet interfaces 64. Therefore, the Gigabit Ether-Channel Processing System 51 within the OIR nodes 31a will convert the Inf iniBand packet into a plurality of smaller Ethernet frames before encapsulating it into the OIR payload. The receiving OIR node 31b will reassemble the Ethernet frames into a complete InfiniBand packet.

[0190] FIG. 6 demonstrates that when the intermediate OIR nodes 31b and 31c are using SONET interfaces 65, the InfiniBand packet will be encapsulated within an OIR payload and transported using the SONET interface 65.

[0191] Another sample transport demonstrated in FIG. 6 is the 10-Gigabit Ethernet interface 66 between the intermediate OIR nodes 31c and the destined OIR node 31d. The OIR payload, which contains the InfiniBand packet encapsulated within, will be transported directly on the 10-Gigabit Ethernet interface 66 to OIR node 31c without further processing. At the destined OIR node 31d, the InfiniBand packet will be forwarded to the destined port on the InfiniBand Interface card 42 to be transported to the InfiniBand end node 62a.

[0192] FIG. 7 illustrates the method of how the InfiniBand packets are switched using the OIR system 31.

[0193] From the InfiniBand client's 61a point of view, the InfiniBand Host Operations 61b can be performed directly on the InfiniBand Target 62a. The details of how the InfiniBand Work Requests are performed are transparent to the Client 61a. The actual operation in packet relaying is done by the OIR system 31.

[0194] From an operational point of view, the InfiniBand end nodes 62a are connected to a true InfiniBand switch as defined in the InfiniBand Architecture Specification (see reference [1]), although the OIR system 31 provides a multitude of InfiniBand ports than any existing InfiniBand switching device. The InfiniBand card 42 will detect whether the connecting InfiniBand end nodes is an InfiniBand host (through its Host Channel Adapter interface) or an InfiniBand target (through its Target Channel Adapter interface) and set up the link accordingly. The Packet relay function 69 is provided by the OIR system 31 to switch InfiniBand packets from one InfiniBand interface port 63 to another interface port 63 within the same interface card 42 or to another interface card on the same OIR system 31.

[0195] FIG. 8 illustrates the method of how the InfiniBand packets are transported through the OIR nodes 31a, 31b using the Gigabit Ether-Channel interfaces 65. The Gigabit Ether-Channel is composed of a plurality of 1-Gigabit Ethernet interfaces 65. The multiple 1-Gigabit Ethernet bandwidth is aggregated into a logical channel to support the higher bandwidth that is received from the InfiniBand interface. The fragmentation and de-fragmentation functions are performed by the Gigabit Ether-Channel processing system 51.

[0196] The InfiniBand end nodes 62a can interface to the OIR system 31a, 31b using a single InfiniBand fiber link. The OIR system 31a, 31b will in turn fragment and defragment the InfiniBand frames into multiple 1-Gigabit Ethernet frame before passing them between the OIR systems 31a, 31b. The assignment of the 1-Gigabit Ethernet ports to the Ether-Channel can be provisioned by the user or can be done using the default configuration.

[0197] FIG. 9 illustrates the method on how the InfiniBand packets are routed through the OIR system 93,94 using the SONET interface. InfiniBand frames transported over SONET use the Point-to-Point protocol, based on IETF Packet over SONET (see reference [2], [3], and [4]). PPP protocol uses the SONET transport as a byte-oriented full-duplex synchronous link. The OIR Point-to-Point Packet 140 is mapped into the SONET Synchronous Payload Envelope (SPE) based on the payload mapping. The packet data will be aligned at the SPE octet and occupy the full forty-eight octets for the OC48c frame.

[0198] The InfiniBand end nodes 62a interface to the OIR system 31c through the InfiniBand interface. The InfiniBand frames are encapsulated into the OIR Point-to-Point packet 140. The packet is then mapped into the SONET SPE and forwarded to the destined OIR system 31c. At the destined OIR system, the OIR system will strip out the InfiniBand frames from the OIR packet before forwarding it to the InfiniBand end nodes 62a.

[0199] FIG. 10 illustrates the method of how the InfiniBand packets are switched using the DWDM Interfaces 67. The DWDM interface is a more effectively way of transporting data between optical system. It is a fiber-optic transmission technique that involves the process of multiplexing a multitude of wavelength signals onto a single fiber. In the OIR system 31d, each DWDM Interface card 43 can support a plurality of wavelength signals on each port. The DWDM layer within the OIR system has been designed in compliance with industry standards (see reference [13]). The bit rate and protocol transparency allows the DWDM interface to transport native enterprise data traffic like InfiniBand, Gigabit Ethernet, Fibre Channel, SONET, IP, iSCSI, etc. on different channels. It brings the flexibility to the OIR system in relation to the overall transport system; it can connect directly to any signal format without extra equipment.

[0200] The OIR system contains an optical amplifier that is fueled by a compound called Erbium, operated in a specific band of the frequency spectrum. It is optimized for interfacing with existing fiber and can carry a multitude of lightwave channels.

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[0201] InfiniBand frames transported over DWDM use Point-to-Point (PPP) protocol. PPP protocol uses the DWDM transport as a byte oriented full-duplex link. The OIR system will use the lightweight SONET layer approach to transport OIR Packet over the DWDM transport. That is, the OIR system will preserve the SONET header as a means of framing the data but will not use the Time Division Multiplexing (TDM) approach to transport payload. The OIR packet is transported to the next OIR system **31d** "as is". The OIR system **31d** will have the intelligence to add and drop wavelengths at the destination OIR system **31d**.

[0202] Forward Error Correction (FEC) function is performed in all OIR systems **31d** to provide the capability to detect signal errors. The FEC data is put into the unused portion of the SONET header. Network restoration and survivability functions will be supported by the Multiple Protocol Lambda Switching (MPLS) protocol (see reference [11]).

[0203] OIR systems **31d** can interconnect to the InfiniBand end nodes **62a** by establishing a light path between the two end nodes. This light path is a logical path that is established so that the optical signal can traverse the intermediate OIR system **31d** to reach the destination end node from an originating end node.

[0204] The InfiniBand end nodes **62a** interface to the OIR system **31d** through InfiniBand interfaces **63**. The InfiniBand frames are encapsulated into the OIR Point-to-Point packet **140**. Based on the destination address, a route and wavelength are assigned to carry the OIR packet. The packet is then inserted into the wavelength transport and forwarded to the destination OIR system **94, 95**. At the destination OIR system, the Optical-Electrical-Optical (OEO) function is performed to convert the OIR packet into machine-readable form. The OIR system **31d** will then strip out the InfiniBand frames **150** from the OIR packet **140** before forwarding it to the InfiniBand end nodes **62a**.

[0205] FIG. 11 illustrates the method of how the Fibre Channel Frames are switched using the DWDM Interfaces **67**. The operation in transporting the Fibre Channel frames through the DWDM interface of the OIR system network is similar to what has been discussed in previous paragraphs.

[0206] The Fibre Channel end nodes **62b** interface to the OIR system **31d** through Fibre Channel interfaces **68**. The Fibre Channel frames are encapsulated into the OIR Point-to-Point packet **140**. Based on the destination address, a route and wavelength are assigned to carry the OIR packet. The packet is then inserted into the wavelength transport and forwarded to the destination OIR system **31d**. At the destined OIR system **31d**, the Optical-Electrical-Optical (OEO) function is performed to convert the OIR packet into machine-readable form. The OIR system will then strip out the Fibre Channel frames **160** from the OIR packet **140** before forwarding it to the Fibre Channel end nodes **62b**.

[0207] FIG. 12 illustrates the method of how the InfiniBand Host Client can interface with the Fiber Channel Target device through the OIR system InfiniBand/Fibre Channel Gateway function. The InfiniBand Frames switching between OIR system **31d** is the same as described in discussion for FIG. 10. The major difference is that the destination OIR system**31d** will perform the InfiniBand/Fibre Channel gateway function to bridge the InfiniBand data and the Fibre Channel data.

[0208] To support the InfiniBand/Fibre Channel gateway function, the user will provision and activate the InfiniBand/Fibre Channel Gateway **121** function at the OIR system **31d**. A gateway server function **121** will be started and it will also setup the link between the Fibre Channel devices that are connected to the OIR Fibre Channel Interface ports **68**. The gateway server will automatically setup the links with the Fibre Channel devices.

[0209] The gateway server will also advertise itself to the other InfiniBand Subnet Management Agents (SMA) (as described in InfiniBand Architecture Specification, reference [1]) about the existence of InfiniBand target devices. The InfiniBand end node **62a**, which is acting as a Host Server, will treat the Fibre Channel devices attached to the OIR system **31d** as targets; it will be able to perform InfiniBand operations on them.

[0210] The InfiniBand data are carried from the Client **61a**, through the intermediate OIR system **31d** to the destination OIR system **31d**. The InfiniBand frame data **150** is stripped from the OIR packet **140** and is forwarded to the InfiniBand/Fibre Channel gateway server **121**. The gateway server **121** converts the InfiniBand data **150** into meaningful Fibre Channel commands/control information **160** and passes it down to the Fibre Channel device **62b** through the destination Fibre Channel Interface port **68**. The Fibre Channel device **62b** that is attached to the Fibre Channel Interface port **68** will respond to the Fibre Channel commands/control information **160** as required. A similar process is performed when the Fibre Channel device **62b** returns the storage data to the InfiniBand host **62a**.

[0211] FIG. 13 illustrates the method of how the InfiniBand Host Client **61a** can interface with the iSCSI Target device **62c** through the OIR system InfiniBand/iSCSI Gateway function **131**. The InfiniBand Frames switching between OIR systems **31d** is the same as described in discussion for FIG. 10. The major difference is that the destination OIR system will perform the InfiniBand/iSCSI gateway function to bridge the InfiniBand data **150** and the iSCSI data **180**.

[0212] iSCSI is a storage networking technology, which allows users to use high-speed SCSI (Small Computer Systems Interfaces) devices through out Ethernet networks. Natively, the OIR system **31d** allows SCSI data to be transported through the OIR system **31** network using the Gigabit Ethernet interfaces **64**. However, when InfiniBand is used from the Client **61a** to access iSCSI devices **62c**, the OIR system **31d** can provide an additional benefit.

[0213] The benefit of using the OIR system **31** is that the Client **61a** can perform the same InfiniBand operation **61b** on a plurality of devices, including InfiniBand Target devices **62a**, Fibre Channel devices **62b**, and iSCSI devices **62c**. Similar to the discussion on InfiniBand/Fibre Channel gateway operation, the InfiniBand data **150** will be converted to ISCSI command/control information **180** by the InfiniBand/iSCSI Gateway server **131**. The iSCSI information **180** is forwarded by the OIR system **31d** through its Gigabit Ethernet interface **64** to the iSCSI device **62c**.

Data Format—FIG. 14, 15, 16, 17, and 18

[0214] FIG. 14 illustrates the Optical InfiniBand Router (OIR) Point-to-Point packet format **140**. The OIR packet

140 is based on a HDLC-like Point-to-Point framing format described in IETF RFC 1662 (see references [2], and [3]). The following describes the field information:

[0215] Flag 141, 148—The Flag Sequence indicates the beginning or end of a frame.

[0216] Address 142—The Address field contains the binary sequence 11111111, which indicates "all station address". PPP does not assign individual station addresses.

[0217] Control 143—The Control field contains the binary sequence 00000011.

[0218] Protocol ID 144—The Protocol ID identifies the network-layer protocol of specific packets. The proposed value for this field for InfiniBand is 0x0042, Fibre Channel is 0x0041, and iSCSI is 0x0043. (Internet Protocol field value is 0x0021).

[0219] Label 145—The Label field supports the OIR Label switching function.

[0220] Information field 146—Data frame is inserted in the Information field with a maximum length of 64 K octets. (Note: the default length of 1,500 bytes is used for small packet).

[0221] FCS (Frame Check Sequence) field 147—A 32-bit (4 bytes) field provides the frame checking function. (Note: 32 bits instead of 16 bits is used to improve error detection.)

[0222] FIG. 15 illustrates the method of how an InfiniBand Frame 150 is encapsulated within the Optical InfiniBand Router (OIR) Point-to-Point packet format The following describes the field information for the InfiniBand Frame:

[0223] Routing Header 150*a* —contains the fields for routing the packet between subnets.

[0224] Transport Header 150*b* —contains the fields for InfiniBand transports.

[0225] Payload 150*c* —contains actual frame data.

[0226] CRC 150*d* —Cyclic Redundancy Check data

[0227] FIG. 16 illustrates the method of how a Fibre Channel Frame 160 is encapsulated within the Optical InfiniBand Router (OIR) Point-to-Point packet format 140. The following describes the field information for the Fibre Channel Frame:

[0228] Start of Frame 160*a* —indicates beginning of a frame.

[0229] Fibre Channel Header 160*b*—contains control and addressing information associated with the Fibre Channel frame .

[0230] Optional Header 160*c*—contains a set of architected extensions to the frame header.

[0231] Payload 160*d*—contains actual frame data.

[0232] CRC 160*e* —Cyclic Redundancy Check data

[0233] End of Frame 160*f*—indicates end of a frame

[0234] FIG. 17 illustrates the method of how an Ethernet Frame 170 is encapsulated within the Optical InfiniBand Router (OIR) Point-to-Point packet format 140. The following describes the field information for the Ethernet Frame 170:

[0235] Preamble 170*a* —indicates beginning of a frame. The alternating "1, 0" pattern in the preamble is used by the Manchester encoder/decoder to "lock on" to the incoming receive bit stream and allow data decoding.

[0236] Start Frame Delimiter (SFD) 170*b* —is defined as a byte with the "10101011" pattern.

[0237] Destination Address (DA) 170*c* —denotes the MAC address of the receiving node.

[0238] Source Address (SA) 170*d* —denotes the MAC address of the sending node.

[0239] Length (LEN) 170*e* —indicates the frame size.

[0240] Data 170*f* —contains actual frame data.

[0241] PAD 170*g* —contains optional padding bytes.

[0242] Frame Check Sequence (FCS) 170*h* —for error detection.

[0243] FIG. 18 illustrates the method of how iSCSI Frame 180 is encapsulated within the Optical InfiniBand Router (OIR) Point-to-Point packet format 140. The iSCSI Frame 180 is basically SCSI data encapsulated within the IP Packet, which in turn is wrapped within the Ethernet frame 170. The following describes the Internet Protocol (IP) field information:

[0244] IP Header 181—contains the Internet Protocol Header Information.

[0245] SCSI 182—contains SCSI commands.

[0246] FIG. 19 illustrates the method of how InfiniBand Processing System 55 processes the input data, while FIG. 20 illustrates the method of how the said InfiniBand Processing System 55 processes the output data.

[0247] FIG. 21 illustrates the method of how Gigabit Ether-Channel Processing System 51 processes the input data, while FIG. 22 illustrates the method of how the said Gigabit Ether-Channel Processing System 51 processes the output data.

[0248] FIG. 23 illustrates the method of how Fibre Channel Processing System 56 processes the input data, while FIG. 24 illustrates the method of how the said Fibre Channel Processing System 56 processes the output data.

[0249] FIG. 25 illustrates the method of how Processing Systems for OC-48 SONET interface, OC-192 SONET interface, DWDM interface, and 10-Gigabit Ethernet interface 53, 57, 54, 52 process the input data, while FIG. 26 illustrates the method of how the said Processing Systems 53, 57, 54, 52 process the output data.

CONCLUSION, RAMIFICATIONS, AND SCOPE

[0250] In addition to the combined InfiniBand switching and routing functions, the OIR system provides system and network multi-services for the following areas:

[0251] InfiniBand packets over Gigabit Ethernet Channels (Ether-Channel) for inter-subnet routing

[0252] InfiniBand packets over Ether-Channels and SONET for inter-network routing

[0253] InfiniBand packets over Multi-Wavelength DWDM for WAN-based inter-domain routing/transport

[0254] InfiniBand packets to Storage Area Network gateway (Fibre Channel gateway) function

[0255] InfiniBand packets to Network Attached Storage gateway (iSCSI gateway) function

[0256] Full InfiniBand Network Domain Management

[0257] InfiniBand Quality of Service (QoS)/Bandwidth control to Optical Network QoS/Bandwidth control mapping functions

[0258] This invention takes advantages of the InfiniBand architecture, extending it to incorporate the InfiniBand capabilities to go beyond the local area network. By using the optical networking capabilities, it allows processing modules and I/O modules to be connected through the local network, through the metro area network, and even to the wide area network.

[0259] In addition to the multi-services support functions, the OIR also include the following features to provide a highly reliable infrastructure:

[0260] Fully NEBS-compliant hardware platform

[0261] Interchangeable line card modules

[0262] Non-blocking, redundant switching fabric ensures highest service quality

[0263] Support for multiple access and transport types, including InfiniBand, Gigabit Ethernet, SONET, DWDM

[0264] Full 1+1 redundancy protects management processors and switching fabric modules

[0265] Hot-swappable components and support for online software and firmware upgrades offer the highest availability

[0266] Remote management tools accommodate either conventional or next generation network management systems

[0267] Replaces multiple network elements by performing functions that include InfiniBand switching and routing, IP switching and routing, SAN/NAS gateway functions, and SONET/DWDM payload switching

[0268] This invention will be unique and easily differentiated from competitive products because of its comprehensive service management solution, including network, system, and application levels management. It offers the simplicity of Ethernet technology, combined with the reliability and performance of the optical technology. It allows the customers to tune the system to deliver scalable, guaranteed rate access to multiple network services. This will give our customer the important time-to-market and differentiated service advantage they need to compete in the new networking market.

[0269] To the potential customer, the OIR is the natural choice given its multi-service nature, speed, and undisputed cost advantage. OIR also brings new dimensions of simplicity compare to earlier generation wide-area network (WAN) access technologies. It will become the service demarcation point for traffic in LAN, SAN, NAS, MAN, and WAN.

[0270] Multi-service access eliminates the incorporation of multiple networking transport switches/routers within a data center. Any service can be attached to the OIR without the complexity in managing the different characteristics of multi-vendor equipment.

[0271] Traffic is encapsulated into the OIR transport and groomed to high-speed SONET/SDH paths, or trunks, which ultimately terminates at the required Internet, native Ethernet, and/or InfiniBand-based service destination. Efficiency is assured with advanced bandwidth management capabilities plus the ability to share "trunks" among multiple customers and across multiple platforms

[0272] This invention simplifies the overall system network architecture by collapsing the capabilities of InfiniBand, IP switches and routers, SONET Add-Drop Multiplexers, and DWDM into one cost-effective and powerful optical router. Potential customers can select one or more service components that they want to use within our system. The service components can be interfaces for InfiniBand (2.5 gigabit or 10 gigabit), Gigabit Ethernet (3x1 gigabit or 10 gigabit), SONET (OC-48 or OC-192), or DWDM (4 channels OC-48 or 4 channels OC-192).

BEST MODE FOR CARRYING OUT THE INVENTION

[0273] The problems solved by this invention is:

[0274] how to extend the System-Area Networking of the InfiniBand technology beyond the limited distance. The current specification defines the fiber connection distance to be less than 100 meters.

[0275] how to transport and route data between InfiniBand devices using the Gigabit Ethernet-based data transport.

[0276] how to combine a plurality of Gigabit Ethernet data streams into one InfiniBand data stream.

[0277] how to segment data between InfiniBand devices and the Gigabit Ethernet-based devices

[0278] how to transport and route data between InfiniBand devices using the SONET Add-Drop Multiplexing data transport.

[0279] how to transport and route data between InfiniBand devices using the Dense Wavelength Division Multiplexing (DWDM) data transport.

[0280] how to transport and route data between Fibre Channel devices using the Dense Wavelength Division Multiplexing (DWDM) data transport.

[0281] Operationally, one uses the Optical InfiniBand routing device to transport data from InfiniBand host or target devices through the OIR network to the destination InfiniBand host or target devices.

PTO/SB/21 (07-06)
Approved for use through 09/30/2006. OMB 0651-0031
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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	10/027,821
Filing Date	12-19-2001
First Named Inventor	Denis Proulx, et al.
Art Unit	2174
Examiner Name	Peng, Ke
Attorney Docket Number	1400.1374890
Total Number of Pages in This Submission	16

ENCLOSURES *(Check all that apply)*

- [x] Fee Transmittal Form
  - [x] Fee Attached
- [x] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [x] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/ Incomplete Application
  - [ ] Reply to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) ____________
  - [ ] Landscape Table on CD
- [ ] After Allowance Communication to TC
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to TC (Appeal Notice, Brief, Reply Brief)
- [ ] Proprietary Information
- [ ] Status Letter
- [x] Other Enclosure(s) (please identify below):

Return Receipt Postcard

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name			
Signature	*Ross D Snyder*		
Printed name	Ross D. Snyder		
Date	04-23-2007	Reg. No.	37,730

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature	*Ross D Snyder*		
Typed or printed name	Ross D. Snyder	Date	04-23-2007

This collection of information is required by 37 CFR 1.5. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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IFW 2174

PTO/SB/17 (01-06)
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Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2006

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT	($) 1,020.00

Complete if Known	
Application Number	10-027,821
Filing Date	12-19-2001
First Named Inventor	Denis Proulx, et al.
Examiner Name	Peng, Ke
Art Unit	2174
Attorney Docket No.	1400.1374890

METHOD OF PAYMENT (check all that apply)

☑ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): ____

☑ Deposit Account Deposit Account Number: 50-1566 Deposit Account Name: Ross D. Snyder & Assoc.

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☐ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, except for the filing fee

☑ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 ☑ Credit any overpayments

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FEE CALCULATION (All the fees below are due upon filing or may be subject to a surcharge.)

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

Application Type	FILING FEES Fee ($)	FILING FEES Small Entity Fee ($)	SEARCH FEES Fee ($)	SEARCH FEES Small Entity Fee ($)	EXAMINATION FEES Fee ($)	EXAMINATION FEES Small Entity Fee ($)	Fees Paid ($)
Utility	300	150	500	250	200	100	
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 (including Reissues)	50	25
Each independent claim over 3 (including Reissues)	200	100
Multiple dependent claims	360	180

Total Claims ____ - 20 or HP = Extra Claims ____ x Fee ($) ____ = Fee Paid ($) ____

HP = highest number of total claims paid for, if greater than 20.

Indep. Claims ____ - 3 or HP = Extra Claims ____ x Fee ($) ____ = Fee Paid ($) ____

HP = highest number of independent claims paid for, if greater than 3.

Multiple Dependent Claims Fee ($) ____ Fee Paid ($) ____

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets ____ - 100 = Extra Sheets ____ / 50 = Number of each additional 50 or fraction thereof ____ (round up to a whole number) x Fee ($) ____ = Fee Paid ($) ____

4. OTHER FEE(S) Fees Paid ($)

Non-English Specification, $130 fee (no small entity discount)

Other (e.g., late filing surcharge): Extension Fee 1,020.00

SUBMITTED BY

Signature	*Ross D. Snyder*	Registration No. (Attorney/Agent) 37,730	Telephone 512-347-9223
Name (Print/Type)	Ross D. Snyder		Date 04-23-2007

PTO/SB/22 (12-04)
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PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a) FY 2005 *(Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).)*	Docket Number (Optional) 1400.1374890
Application Number 10/027,821	Filed 12-19-2001
For METHOD AND SYSTEM FOR IP LINK MANAGEMENT	
Art Unit 2174	Examiner Ke, Peng

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

	Fee	Small Entity Fee	
☐ One month (37 CFR 1.17(a)(1)).	$120	$60	$
☐ Two months (37 CFR 1.17(a)(2))	$450	$225	$
☒ Three months (37 CFR 1.17(a)(3))	$1020	$510	$ 1,020.00
☐ Four months (37 CFR 1.17(a)(4))	$1590	$795	$
☐ Five months (37 CFR 1.17(a)(5))	$2160	$1080	$

☐ Applicant claims small entity status. See 37 CFR 1.27.

☒ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 50-1566. I have enclosed a duplicate copy of this sheet.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the ☐ applicant/inventor.

☐ assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) is enclosed (Form PTO/SB/96).

☒ attorney or agent of record. Registration Number 37,730

☐ attorney or agent under 37 CFR 1.34.
Registration number if acting under 37 CFR 1.34 ____________

Ross D Snyder — Signature | 04-23-2007 — Date

Ross D. Snyder, Reg. No. 37,730 — Typed or printed name | (512) 347-9223 — Telephone Number

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.

☐ Total of ____________ forms are submitted.

04/26/2007 SSESHE1 00000033 10027821
01 FC:1253 1020.00 OP

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Denis Proulx, et al.

Title: METHOD AND SYSTEM FOR IP LINK MANAGEMENT

App. No.: 10/027,821 Filed: 12-19-2001

Examiner: Ke, Peng Group Art Unit: 2174

Atty. Dkt. No. 1400.1374890

Mail Stop Amendment
Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

RESPONSE

Dear Sir:

In response to the Office action of October 23, 2006, Applicant submits the following response:

In the Claims:

1. (Original) A network administration method for provisioning logical configuration links for at least two network devices through a dedicated graphical user interface form, the method comprising:

selecting a network device having at least one network interface through the dedicated graphical user interface form;

determining local interface and next neighbor information for the network device;

determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database;

creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database;

storing the new logical configuration link in the logical link database;

validating the new logical configuration link;

sending the new logical configuration link to the network device; and

displaying a graphical representation of the new logical configuration link on a display device.

2. (Original) The method of claim 1, wherein the step of creating a new logical configuration link further comprises the steps of:

selecting a link type;

selecting a link numbering type for the new logical configuration link;

selecting a link application for the new logical configuration link;

selecting a sub layer interface type for the new logical configuration link;

creating a first endpoint for the new logical configuration link; and

creating a second endpoint for the new logical configuration link.

3. (Original) The method of claim 2, wherein the step of selecting the link type further

comprises the step of:

selecting the link type from among a group consisting of: point-to-point, point-to-IP, and point-to-subnet.

4. (Original) The method of claim 2, wherein the step of selecting a link numbering type further comprises the step of:

selecting the link numbering type from a group consisting of: a numbered type and an unnumbered type.

5. (Original) The method of claim 2, wherein the step of selecting a link application further comprises the step of:

selecting the link application from a group consisting of: Internet Protocol Forwarding, Multi-Protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching.

6. (Original) The method of claim 2, wherein the step of selecting a sub layer interface type further comprises the step of:

selecting the sub layer interface type from a group consisting of: Packet Over Sonet, Asynchronous Transfer Mode, and GigEthernet.

7. (Original) The method of claim 1, further comprising the step of:

modifying a logical configuration link in the logical link database.

8. (Original) The method of claim 1, further comprising the step of:

deleting a logical configuration link in the logical link database.

9. (Original) Apparatus for provisioning logical configuration links comprising:

a logical link database for storing logical configuration links;

a processing system coupled to the logical link database for accessing the logical link database; and

a display device coupled to the processing system for displaying a graphical user

interface form comprising a graphical representation of a logical configuration link.

10. (Original) The apparatus of claim 9 wherein the display device provides an ability to select a network device having at least one network interface through the graphical user interface form.

11. (Original) The apparatus of claim 9 wherein the processing system determines local interface and next neighbor information for the network device.

12. (Original) The apparatus of claim 11 wherein the processing system determines whether the local interface and next neighbor information is associated with one of the logical configuration links stored in the logical link database.

13. (Original) The apparatus of claim 12 wherein the processing system creates a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links stored in the logical link database.

14. (Original) The apparatus of claim 13 wherein the processing system causes the new logical configuration link to be stored in the logical link database.

15. (Original) The apparatus of claim 14 wherein the processing system validates the new logical configuration link.

16. (Original) The apparatus of claim 15 wherein the processing system causes the new logical configuration link to be sent to the network device.

REMARKS/ARGUMENTS

Claims 1-16 are pending in the application. The Examiner states claims 1-15 [*sic*] are rejected. Applicant respectfully requests reconsideration of pending claims 1-16.

The Examiner has rejected claims 1-4 and 7-15 under 35 U.S.C.§102(b) as being anticipated by Hansen (United States Patent No. 5,838,907). Applicant respectfully disagrees.

Regarding claim 1, Applicant submits the cited portions of the cited reference fail to disclose the subject matter of claim 1. As one example, Applicant submits the cited portions of the cited reference fail to disclose "determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database." While the Examiner cites "(column 5, lines 35-65; Subsystem is a logical link database)," Applicant does not see teaching in the cited portion of the cited reference as to the above-referenced "determining" step. As another example, Applicant submits the cited portions of the cited reference fail to disclose "creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database." Applicant notes the Examiner has previously stated, "Hansen does not teach creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database and storing the new logical configuration link in the logical link database." Now, however, Applicant notes the Examiner cites "(column 15, lines 30-50; Unconnected PCI slot are unassociated connection)" as allegedly disclosing such feature. Applicant notes claim 1 does not recited "unassociated connection." Rather, Applicant notes claim 1 recites, in part, "...when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database." Moreover, Applicant does not see teaching as to "creating a new logical configuration link..." in the cited portion of the cited reference. Thus, Applicant submits the Examiner has not made a *prima facie* showing of anticipation with respect to claim 1.

As another example, Applicant submits the cited portions of the cited reference fail to disclose "storing the new logical configuration link in the logical link database." While the Examiner cites "(column 13, lines 10-30)," Applicant can find no reference to "storing" anything in the cited portion of the cited reference. Rather, Applicant notes the cited portion of the cited reference merely refers to

"...the configuration file for the origination device or entity is reviewed...," "...the configuration file for the destination device or entity is reviewed...," "a determinination is made at step 156 that the devices/entities cannot be connected," and "The proposed connection is then deleted...." Thus, Applicant submits the cited portions of the cited reference fail to disclose the subject matter of claim 1.

Regarding claim 2, Applicant submits the cited portions of the cited reference fail to disclose the subject matter of claim 2. As one example, Applicant submits the cited portions of the cited reference fail to disclose "selecting a link numbering type for the new logical configuration link." While the Examiner cites "(column 11, lines 13-30; PCI slots are numbered configuration links)," Applicant does not see mention of "selecting a link numbering type for the new logical configuration link." Thus, Applicant submits the cited portions of the cited reference fail to disclose the subject matter of claim 2.

Regarding claim 3, Applicant submits the cited portions of the cited reference fail to disclose the subject matter of claim 3. Applicant has submitted argument for the allowability of claims 1 and 2, from which claim 3 depends. Thus, Applicant submits claim 3 is also in condition for allowance.

Regarding claim 4, Applicant submits the cited portions of the cited reference fail to disclose the subject matter of claim 4. While the Examiner cites "(column 11, lines 13-30; PCI slots are numbering type, column 13, lines 28-45; a list of connection interface is un-number type)," Applicant reiterates Applicant's argument with respect to claim 2 and further submits Applicant does not see mention of "an unnumbered type" in the cited portion of the cited reference. Therefore, Applicant submits claim 4 is in condition for allowance.

Regarding claim 7, Applicant submits the cited portions of the cited reference fail to disclose the subject matter of claim 7. As one example, Applicant submits the cited portions of the cited reference fail to disclose "modifying a logical configuration link in the logical link database." While the Examiner cites "(column 11, lines 41-53; Editing is modifying)," Applicant notes column 11, line 46 states, in part, "...edit the map...." Applicant further notes column 11, lines 39-44, state, in part, "...if the network administrator decides to go to the network workspace 102 to edit either the blank map initially loaded into the network workspace 102 at step 48 or, if a saved map was retrieved from the map files 16 by executing an 'open file' command at step 52, the retrieved map loaded into the network workspace at step 52,...." Applicant submits such an alleged teaching of "...a logical

configuration link in the logical link database" is inconsistent with what the Examiner alleged to teach the same with respect to claim 1, from which claim 7 depends. Thus, Applicant submits claim 7 is in condition for allowance.

Regarding claim 8, Applicant submits the cited portions of the cited reference fail to disclose the subject matter of claim 8. As one example, Applicant submits the cited portions of the cited reference fail to disclose "deleting a logical configuration link in the logical link database." While the Examiner cites "(column 10, lines 1-20)," Applicant sees reference to "'delete device'" in column 10, line 5, but no other mention of "delete" or "deleting." Applicant submits the Examiner's apparent assertion that "'delete device'" purportedly teaches "deleting a logical configuration link in the logical link database" appears to contradict what the Examiner alleges the cited portions of the cited reference to teach (e.g., with regard to "a logical configuration link") in the rejection of claim 1, from which claim 8 depends. Thus, Applicant submits claim 8 is in condition for allowance.

Regarding claim 9, Applicant submits the cited portions of the cited reference fail to disclose the subject matter of claim 9. As one example, Applicant submits the cited portions of the cited reference fail to disclose "a logical link database for storing logical configuration links." Applicant notes the Examiner has previously stated, "Hansen does not teach a logical link database for storing logical configuration links." Now, however, without elaborating, the Examiner merely states, "As per claim 9, it is of the same scope as claim 1. Supra." Applicant respectfully disagrees. Applicant submits claim 9 differs in numerous respects from claim 1. Applicant submits the Examiner has failed to make a *prima facie* showing of anticipation with respect to claim 9. As one example, Applicant sees no allegation by the Examiner, either with respect to claim 9 or with respect to claim 1, that the cited portions of the cited reference disclose "a processing system coupled to the logical link database for accessing the logical link database." Thus, Applicant submits claim 9 is in condition for allowance.

Regarding claim 10, Applicant submits the cited portions of the cited reference fail to disclose the subject matter of claim 10. Applicant has submitted argument for the allowability of claim 9, from which claim 10 depends. Thus, Applicant submits claim 10 is also in condition for allowance.

Regarding claim 11, Applicant submits the cited portions of the cited reference fail to disclose the subject matter of claim 11. As one example, Applicant submits the cited portions of the cited reference fail to disclose "...wherein the processing system determines local interface and next

neighbor information for the network device." While the Examiner cites "(figure 7, items 114, 116, 120, 126, 122, 118, and 124)," Applicant reiterates Applicant's argument with respect to claim 9, from which claim 11 depends, that Applicant sees no allegation by the Examiner, either with respect to claim 9 or with respect to claim 1, that the cited portions of the cited reference disclose "a processing system...." Accordingly, Applicant submits the Examiner has failed to make a *prima facie* showing of anticipation with respect to claim 11 and the cited portions of the cited reference fail to anticipate the subject matter of claim 11. Thus, Applicant submits claim 11 is in condition for allowance.

Regarding claim 12, Applicant submits the cited portions of the cited reference fail to anticipate the subject matter of claim 12. As onc example, Applicant submits the cited portions of the cited reference fail to disclose "...wherein the processing system determines whether the local interface and next neighbor information is associated with onc of the logical configuration links stored in the logical link database." While the Examiner cites, "(column 15, lines 30-50; Unconnected PCI slot are unassociated connection)," Applicant notes claim 12 does not recite "unassociated connection." Moreover, Applicant submits the Examiner's assertion as to the purported teachings of the cited portions of the cited reference with respect to claim 12 appear to contradict the Examiner's assertions as to the purported teachings of the cited portions of the cited reference with respect to one or more claims from which claim 12 depends, either directly or indirectly. Thus, Applicant submits claim 12 is in condition for allowance.

Regarding claim 13, Applicant submits the cited portions of the cited reference fail to anticipate the subject matter of claim 13. As one example, Applicant submits the cited portions of the cited reference fail to disclose "...wherein the processing system creates a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links stored in the logical link database." While the Examiner cites, "(column 13, lines 10-30)," Applicant can find no mention of "creates" in the cited portion of the cited reference. Rather, Applicant notes the cited portion of the cited reference merely refers to "...the configuration file for the origination device or entity is reviewed...," "...the configuration file for the destination device or entity is reviewed...," "a determininination is made at step 156 that the devices/entities cannot be connected," and "The proposed connection is then deleted...." Thus, Applicant submits the cited portions of the cited reference fail to disclose the subject matter of claim 13.

Regarding claim 14, Applicant submits the cited portions of the cited reference fail to anticipate the subject matter of claim 14. As one example, Applicant submits the cited portions of the cited reference fail to disclose "...wherein the processing system causes the new logical configuration link to be stored in the logical link database." While the Examiner cites "(column 13, lines 10-30)," Applicant can find no mention of "stored" in the cited portion of the cited reference. Rather, Applicant notes the cited portion of the cited reference merely refers to "...the configuration file for the origination device or entity is reviewed...," "...the configuration file for the destination device or entity is reviewed...," "a determinination is made at step 156 that the devices/entities cannot be connected," and "The proposed connection is then deleted...." Thus, Applicant submits the cited portions of the cited reference fail to disclose the subject matter of claim 14.

Regarding claim 15, Applicant submits the cited portions of the cited reference fail to anticipate the subject matter of claim 15. As one example, Applicant submits the cited portions of the cited reference fail to disclose "...wherein the processing system validates the new logical configuration link." While the Examiner cites "(column 13, lines 10-30)," Applicant can find no mention of "validates the new logical configuration link" in the cited portion of the cited reference. Rather, Applicant notes the cited portion of the cited reference merely refers to "...the configuration file for the origination device or entity is reviewed...," "...the configuration file for the destination device or entity is reviewed...," "a determinination is made at step 156 that the devices/entities cannot be connected," and "The proposed connection is then deleted...." Thus, Applicant submits the cited portions of the cited reference fail to disclose the subject matter of claim 15.

Regarding claim 16, Applicant submits the cited portions of the cited reference fail to anticipate the subject matter of claim 16. As one example, Applicant submits the cited portions of the cited reference fail to disclose "...wherein the processing system causes the new logical configuration link to be sent to the network device." While the Examiner cites "(column 14, lines 41-60)," Applicant can find no mention of "causes the new logical configuration link to be sent to the network device" in the cited portion of the cited reference. Rather, Applicant submits the Examiner does not identify any element that the Examiner would purport to teach "the network device." Thus, Applicant submits the cited portions of the cited reference fail to disclose the subject matter of claim 16.

The Examiner has rejected claim 5 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Hansen in view of Hansen (United States Patent No. 5,838,907), and further in view of Hardwick (United States Patent No. 5,550,816). Applicant respectfully disagrees.

Regarding claim 5, Applicant notes the Examiner acknowledges "Hansen fails to teach the step of selecting a link application from a group consisting of: Internet Protocol Forwarding, Multi-Protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching." The Examiner alleges the Hardwick reference teaches such feature at "(column 43, lines 60- column 44, lines 5)." However, Applicant can find no mention of "Internet Protocol Forwarding," "Multi-Protocol Label Switching and Internet Protocol Forwarding," or "Multi-Protocol Label Switching" in the cited portion of the Hardwick reference. Thus, Applicant submits the Examiner has not made a *prima facie* showing of obviousness with respect to claim 5. Also, while the Examiner states as a purported motivation for attempting to combine the purported teachings "in order to provide a wide variety of access control tools that permit network managers to define the policy of how network group can interact with themselves," Applicant respectfully disagrees that such purported motivation would suggest combination of the alleged teachings of the cited portions of the cited references. Thus, Applicant submits claim 5 is in condition for allowance.

The Examiner has rejected claim 6 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Hansen (United States Patent No. 5,838,907) in view of Chui (United States Patent No. 2002/0165978). Applicant respectfully disagrees.

Regarding claim 6, Applicant notes the Examiner acknowledges "Hansen fails to teach selecting a sub layer interface type further comprising the step of: Selecting the sub-layer interface type from a group consisting of: Packet over Sonet, Asynchronous Transfer Mode, and GigEthernet." The Examiner alleges the Chui reference teaches such feature at "(Paragraph 0201)." However, Applicant can find no mention of "Asynchronous Transfer Mode" or "GigEthernet" in the cited portion of the Chui reference. Even the mention of "SONET" is in the context of "the lightweight SONET layer approach" where "the OIR system will preserve the SONET header as a means of framing the data but will not use the Time Division Multiplexing (TDM) approach to transport payload." Thus, Applicant submits the Examiner has not made a *prima facie* showing of obviousness with respect to claim 6. Also, while the Examiner states as a purported motivation for attempting to combine the purported teachings "in order to provide a wide variety of access control tools that permit network

managers to define the policy of how network group can interact with themselves." Applicant respectfully disagrees that such purported motivation would suggest combination of the alleged teachings of the cited portions of the cited references. Thus, Applicant submits claim 6 is in condition for allowance.

In Applicant's response to what Applicant considers to be the inappropriately issued Notice of Non-Compliant Amendment mailed 03/16/2006, Applicant petitioned the Commissioner of Patents add the time lost due to the improper issuance of the Notice of Non-Compliant Amendment (37 CFR 1.121) to any patent term adjustment and/or patent term extension to any patent that may issue from the pending application. Applicant also enclosed therewith payment for an extension of time under 37 CFR 1.136(a) to respond to the improperly issued Notice of Non-Compliant Amendment (37 CFR 1.121). However, as Applicant submits Applicant's original response was fully compliant with 37 CFR 1.121, Applicant requested a refund of Applicant's payment. Applicant has received neither of the requested items, Applicant reiterates Applicant's petition and request for such items.

In conclusion, Applicant has overcome all of the Office's rejections, and early notice of allowance to this effect is earnestly solicited. If, for any reason, the Office is unable to allow the Application on the next Office Action, and believes a telephone interview would be helpful, the Examiner is respectfully requested to contact the undersigned attorney.

Respectfully submitted,

04-23-2007
Date

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/027,821	12/19/2001	Denis Proulx	1400.1374890	9507

25697 7590 07/24/2007

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EXAMINER	
KE, PENG	

ART UNIT	PAPER NUMBER
2174	

MAIL DATE	DELIVERY MODE
07/24/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No. 10/027,821	Applicant(s) PROULX ET AL.	
	Examiner Peng Ke	Art Unit 2174	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 April 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-15* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-15* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

This action is responsive to communications: Amendment, filed on 4/26/07.

This action is made final.

Claims 1-15 are pending in this application. Claims 1 and 9 are independent claims.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-4, and 7-15 are rejected under 35 U.S.C. 102(b) as being anticipated by Hansen US Patent 5,838,907.

As per claim 1, Hansen teaches a network administration method for provisioning logical configuration links for at least two network devices through a dedicated graphical user interface form, the method comprising:

Selecting a network device having at least one network interface through the dedicated graphical user interface form; (figure 3b, column 15, lines 18-32; To configure a device, the device must be selected first)

Determining local interface and next neighbor information for the network device; (figure 7, items 114, 116, 120, 126, 122, 118, and 124)

Determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database; (column 5, lines 35-65; Subsystem is a logical link database)

Creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical ink databases; (column 15, lines 30-50; Unconnected PCI slot are unassociated connection)

Storing the new logical configuration link in the logical link database; (column 13, lines 10-30)

Validating the new logical configuration link; (column 13, lines 10-30)

Sending the new logical configuration link to the network device; (column 14, lines 41-60) and

Displaying a graphical representation of the new logical configuration link on a display device. (column 14, lines 41-60)

As per claim 2, Hansen teaches the method of claim 1. Hansen further teaches the step of creating a new logical configuration lik further comprises the steps of ;

Selecting a like type; (column 13, lines 1-10; x. 25, frame relay, PPP and HDLC are link types)

Selecting a link numbering type for the new logical configuration link; (column 11, lines 13-30; PCI slots are numbered configuration links)

Selecting a link application for the new logical configuration link; (column 14, lines 5-25; The script commands are applications; column 13, lines 65-column 14, lines 5)

Selecting a sub layer interface type for the new logical configuration link; (column 14, lines 15-25; Connection identifiers are configuration links)

Creating a first endpoint for the new logical configuration link; and

Creating a second endpoint for the new logical configuration link.(column 13, lines 10-30)

As per claim 3, Hansen teaches the method of claim 2, wherein the step of selecting the link type further comprises the step of:

Selecting the link type from among a group consisting of: point-to-point, point-to-IP, and pint-to-subnet. (column 13, lines 1-10; x. 25, frame relay, PPP and HDLC)

As per claim 4, Hansen teaches the method of claim 4, wherein the step of selecting the a link number type further comprises the step of:

Selecting the link numbering type from a group consisting of: a numbered type and an un-number type. (column 11, lines 13-30; PCI slots are numbering type, column 13, lines 28-45; a list of connection interface is un-number type)

As per claim 7, Hansen teaches the method of claim 1, Hansen further teaches the step of:

Modifying a logical configuration link in the logical link databases. (column 11, lines 41-53; Editing is modifying)

As per claim 8, Hansen teaches the method of claim 1, Hansen further teaches the step of:

Deleting a logical configuration link in the logical link database. (column 10, lines 1-20)

As per claim 9, it is of the same scope as claim 1. Supra.

As per claim 10, Hansen teaches the apparatus of claim 9. Hansen teaches wherein the display device provides an ability to select a network device having at least one network

interface through the graphical user interface form. (figure 3b, column 15, lines 18-32; To configure a device, the device must be selected first)

As per claim 11, Hansen teaches the apparatus of claim 9, Hansen further teaches the processing system determines local interface and next neighbor information for the network device. (figure 7, items 114, 116, 120, 126, 122, 118, and 124)

As per claim 12, Hansen teaches the apparatus of claim 11, Hansen further teaches the processing system determines whether the local interface and next neighbor information is associated with one of the logical configuration links stored in the logical link database. (column 15, lines 30-50; Unconnected PCI slot are unassociated connection)

As per claim 13, Hansen teaches the apparatus of claim 12, Hansen further teaches creates a new logical configuration link when the local interface and next neighbor information is not associate with any of the logical configuration links stored in the logical link database. (column 13, lines 10-30)

As per claim 14, Hansen teaches the apparatus of claim 13, Hansen further teaches the processing system causes the new logical configuration link to be stored in the logical link database. (column 13, lines 10-30)

As per claim 15, Hansen teaches the apparatus of claim 14, Hansen further teaches the processing system validates the new logical configuration link. (column 13, lines 10-30)

As per claim 16, Hansen teaches the apparatus of claim 15, Hansen further teaches the processing system cause the new logical configuration link to be sent to the network device. (column 14, lines 41-60)

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hansen in view of Hansen US Patent 5,838,907 in view of Hardwick US Patent 5,550,816.

As per claim 5, Hansen teaches the method of claim 2. Hansen fails to teach the step of selecting a link application from a group consisting of:

Internet Protocol Forwarding, Multi-Protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching.

Hardwick teaches the step of selecting a link application from a group consisting of:

Internet Protocol Forwarding, Multi-Protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching. (column 43, lines 60- column 44, lines 5)

It would have been obvious to an artisan at the time of the invention to include Hardwick's teaching with method of Hansen in order to provide a wide variety of access control tools that permit network managers to define the policy of how network group can interact within themselves.

Claims 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hansen in view of Hansen US Patent 5,838,907 in view of Chui US Patent 2002/0165978.

As per claim 6, Hansen teaches the method of claim 2, Hansen fails to teach selecting a sub layer interface type further comprises the step of :

Selecting the sub-layer interface type from a group consisting of; Packet over Sonet, Asynchronous Transfer Mode, and GigEthernet.

Chui teaches selecting a sub layer interface type further comprises the step of :

Selecting the sub-layer interface type from a group consisting of; Packet over Sonet, Asynchronous Transfer Mode, and GigEthernet. (Paragraph 0201)

It would have been obvious to an artisan at the time of the invention to include Chui's teaching with method of Hansen in order to provide a wide variety of access control tools that permit network managers to define the policy of how network group can interact within themselves.

Response to Argument

Applicant's arguments filed on 4/26/07 have been fully considered but they are not persuasive.

Applicant's argument focused on the following:

A) Hansen fails to teach "determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database."

B) Hansen fails to teach "creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database and storing the new logical configuration link in the logical link database."

C) Hansen fails to teach "selecting a link numbering type for the new logical configuration link."

Examiner disagrees.

A) The examiner does not agree for the following reasons:

During patent examination, the pending claims must be "given >their< broadest reasonable interpretation consistent with the specification." > In re Hyatt, 211 F.3d 1367, 1372, 54 USPQ2d 1664, 1667 (Fed. Cir. 2000). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Applicant always has the opportunity to amend the claims during prosecution, and broad interpretation by the examiner reduces the possibility that the claim, once issued, will be interpreted more broadly than is justified. In re Prater, 415 F.2d 1393, 1404-05, 162 USPQ 541, 550-51 (CCPA 1969).

In this case, Hansen teaches this limitation because it identifies the location of the configuration file, and the location could be on a local drive or on a network neighborhood. (see Hansen, column 5 ,lines 45-65) By doing that, Hansen determines whether the logical configuration links to a local database or a network database.

B) Hansen teaches this limitation because the PCI slot 3, which is not connected or associated with any logical configure, can be configured to be linked to a network device and configured according to device's information. (see Hansen, column 15 ,lines 40-60) By doing so, Hansen creates a new logical configuration on the PCI slot 3 when none existed before.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Peng Ke whose telephone number is (571) 272-4062. The examiner can normally be reached on M-Th and Alternate Fridays 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kristine L. Kincaid can be reached on (571) 272-4063. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Peng Ke

Kristine Kincaid
KRISTINE KINCAID
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2100

RC27

OIPE JAN 28 2008 PATENT & TRADEMARK OFFICE

PTO/SB/21 (07-06)
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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	10/027,821
Filing Date	12-19-2001
First Named Inventor	Denis Proulx, et al.
Art Unit	2174
Examiner Name	Peng, Ke
Attorney Docket Number	1400.1374890
Total Number of Pages in This Submission	17

ENCLOSURES *(Check all that apply)*

- [x] Fee Transmittal Form
  - [x] Fee Attached
- [x] Amendment/Reply
  - [x] After Final
  - [ ] Affidavits/declaration(s)
- [x] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/ Incomplete Application
  - [ ] Reply to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) ______
  - [ ] Landscape Table on CD
- [ ] After Allowance Communication to TC
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to TC (Appeal Notice, Brief, Reply Brief)
- [ ] Proprietary Information
- [ ] Status Letter
- [x] Other Enclosure(s) (please Identify below):

Request for Continued Examination
Return Receipt Postcard

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name			
Signature	[signature]		
Printed name	Ross D. Snyder		
Date	01/24/2008	Reg. No.	37,730

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature	[signature]		
Typed or printed name	Ross D. Snyder, Reg. No. 37,730	Date	01/24/2008

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PTO/SB/30 (10-07)
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Request for Continued Examination (RCE) Transmittal

Address to:
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Alexandria, VA 22313-1450

Application Number	10/027,821
Filing Date	12-19-2001
First Named Inventor	Denis Proulx et al.
Art Unit	2174
Examiner Name	Ke, Peng
Attorney Docket Number	1400.1374890

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. **Submission required under 37 CFR 1.114** Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).
   - a. ☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.
     - i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on ________
     - ii. ☐ Other ________
   - b. ☑ Enclosed
     - i. ☑ Amendment/Reply
     - ii. ☐ Affidavit(s)/ Declaration(s)
     - iii. ☐ Information Disclosure Statement (IDS)
     - iv. ☐ Other ________
2. **Miscellaneous**
   - a. ☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of ________ months. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)
   - b. ☐ Other ________
3. **Fees** The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.
   - a. ☑ The Director is hereby authorized to charge the following fees, any underpayment of fees, or credit any overpayments, to Deposit Account No. 50-1566. I have enclosed a duplicate copy of this sheet.
     - i. ☑ RCE fee required under 37 CFR 1.17(e)
     - ii. ☑ Extension of time fee (37 CFR 1.136 and 1.17)
     - iii. ☐ Other ________
   - b. ☑ Check in the amount of $ 1,860.00 enclosed
   - c. ☐ Payment by credit card (Form PTO-2038 enclosed)

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature	[signature]	Date	01/24/2008
Name (Print/Type)	Ross D. Snyder	Registration No.	37,730

CERTIFICATE OF MAILING OR TRANSMISSION

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop RCE, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450 or facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

Signature	[signature]		
Name (Print/Type)	Ross D. Snyder, Reg. No. 37,730	Date	01/24/2008

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop RCE, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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01/29/2008 SSITHIB1 00000022 10027821
01 FC:1801 810.00 DP

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OIPE JAN 28 2008

Effective on 12/08/2004.
Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2008

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 1,860.00

Complete if Known	
Application Number	10/027,821
Filing Date	12-19-2001
First Named Inventor	Denis Proulx et al.
Examiner Name	Ke, Peng
Art Unit	2174
Attorney Docket No.	1400.1374890

METHOD OF PAYMENT (check all that apply)

☑ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): ____

☑ Deposit Account Deposit Account Number: 50-1566 Deposit Account Name: Ross D. Snyder & Assoc.

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☑ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, except for the filing fee

☑ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 ☑ Credit any overpayments

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FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

	FILING FEES		SEARCH FEES		EXAMINATION FEES		
Application Type	Fee ($)	Small Entity Fee ($)	Fee ($)	Small Entity Fee ($)	Fee ($)	Small Entity Fee ($)	Fees Paid ($)
Utility	310	155	510	255	210	105	
Design	210	105	100	50	130	65	
Plant	210	105	310	155	160	80	
Reissue	310	155	510	255	620	310	
Provisional	210	105	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 (including Reissues)	50	25
Each independent claim over 3 (including Reissues)	210	105
Multiple dependent claims	370	185

Total Claims ____ - 20 or HP = Extra Claims ____ x Fee ($) ____ = Fee Paid ($) ____

HP = highest number of total claims paid for, if greater than 20.

Multiple Dependent Claims: Fee ($) ____ Fee Paid ($) ____

Indep. Claims ____ - 3 or HP = Extra Claims ____ x Fee ($) ____ = Fee Paid ($) ____

HP = highest number of independent claims paid for, if greater than 3.

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $260 ($130 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets ____ - 100 = Extra Sheets ____ / 50 = Number of each additional 50 or fraction thereof ____ (round up to a whole number) x Fee ($) ____ = Fee Paid ($) ____

4. OTHER FEE(S) Fees Paid ($)

Non-English Specification, $130 fee (no small entity discount) ____

Other (e.g., late filing surcharge): RCE Fee + Extension Fee 1,860.00

SUBMITTED BY			
Signature	[signature]	Registration No. (Attorney/Agent) 37,730	Telephone 512-347-9223
Name (Print/Type)	Ross D. Snyder		Date 01/24/2008

This collection of information is required by 37 CFR 1.136. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/SB/22 (12-04)
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PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a) FY 2005 *(Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).)*	Docket Number (Optional) 1400.1374890
Application Number 10/027,821	Filed 12-19-2001
For METHOD AND APPARATUS FOR IP LINK MANAGEMENT	
Art Unit 2174	Examiner Ke, Peng

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

	Fee	Small Entity Fee	
☐ One month (37 CFR 1.17(a)(1))	$120	$60	$______
☐ Two months (37 CFR 1.17(a)(2))	$450	$225	$______
☒ Three months (37 CFR 1.17(a)(3))	$1020	$510	$ 1,050.00
☐ Four months (37 CFR 1.17(a)(4))	$1590	$795	$______
☐ Five months (37 CFR 1.17(a)(5))	$2160	$1080	$______

☐ Applicant claims small entity status. See 37 CFR 1.27.

☒ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 50-1566. I have enclosed a duplicate copy of this sheet.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the ☐ applicant/inventor.

☐ assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) is enclosed (Form PTO/SB/96).

☒ attorney or agent of record. Registration Number 37,730

☐ attorney or agent under 37 CFR 1.34.
Registration number if acting under 37 CFR 1.34 ______

Signature ______ Date 01/24/2008

Ross D. Snyder, Reg. No. 37,730 — Typed or printed name
(512) 347-9223 — Telephone Number

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.

☐ Total of ______ forms are submitted.

01/29/2008 SSITHIB1 00000082 10027821
02 FC:1253 1050.00 OP

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Denis Proulx, et al.

Title: METHOD AND SYSTEM FOR IP LINK MANAGEMENT

App. No.: 10/027,821 Filed: 12-19-2001

Examiner: Ke, Peng Group Art Unit: 2174

Atty. Dkt. No. 1400.1374890

Mail Stop AF
Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

RESPONSE

Dear Sir:

In response to the Office action of July 24, 2007, Applicant submits the following response:

In the Claims:

1. (Original) A network administration method for provisioning logical configuration links for at least two network devices through a dedicated graphical user interface form, the method comprising:

selecting a network device having at least one network interface through the dedicated graphical user interface form;

determining local interface and next neighbor information for the network device;

determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database;

creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database;

storing the new logical configuration link in the logical link database;

validating the new logical configuration link;

sending the new logical configuration link to the network device; and

displaying a graphical representation of the new logical configuration link on a display device.

2. (Original) The method of claim 1, wherein the step of creating a new logical configuration link further comprises the steps of:

selecting a link type;

selecting a link numbering type for the new logical configuration link;

selecting a link application for the new logical configuration link;

selecting a sub layer interface type for the new logical configuration link;

creating a first endpoint for the new logical configuration link; and

creating a second endpoint for the new logical configuration link.

3. (Original) The method of claim 2, wherein the step of selecting the link type further comprises the step of:

selecting the link type from among a group consisting of: point-to-point, point-to-IP, and point-to-subnet.

4. (Original) The method of claim 2, wherein the step of selecting a link numbering type further comprises the step of:

selecting the link numbering type from a group consisting of: a numbered type and an unnumbered type.

5. (Original) The method of claim 2, wherein the step of selecting a link application further comprises the step of:

selecting the link application from a group consisting of: Internet Protocol Forwarding, Multi-Protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching.

6. (Original) The method of claim 2, wherein the step of selecting a sub layer interface type further comprises the step of:

selecting the sub layer interface type from a group consisting of: Packet Over Sonet, Asynchronous Transfer Mode, and GigEthernet.

7. (Original) The method of claim 1, further comprising the step of:

modifying a logical configuration link in the logical link database.

8. (Original) The method of claim 1, further comprising the step of:

deleting a logical configuration link in the logical link database.

9. (Original) Apparatus for provisioning logical configuration links comprising:

a logical link database for storing logical configuration links;

a processing system coupled to the logical link database for accessing the logical link database; and

a display device coupled to the processing system for displaying a graphical user interface form comprising a graphical representation of a logical configuration link.

10. (Original) The apparatus of claim 9 wherein the display device provides an ability to select a network device having at least one network interface through the graphical user interface form.

11. (Original) The apparatus of claim 9 wherein the processing system determines local interface and next neighbor information for the network device.

12. (Original) The apparatus of claim 11 wherein the processing system determines whether the local interface and next neighbor information is associated with one of the logical configuration links stored in the logical link database.

13. (Original) The apparatus of claim 12 wherein the processing system creates a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links stored in the logical link database.

14. (Original) The apparatus of claim 13 wherein the processing system causes the new logical configuration link to be stored in the logical link database.

15. (Original) The apparatus of claim 14 wherein the processing system validates the new logical configuration link.

16. (Original) The apparatus of claim 15 wherein the processing system causes the new logical configuration link to be sent to the network device.

17. (New) The method of claim 1 wherein creating the new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database occurs based on interfaces information entered by a user.

18. (New) A method comprising:

selecting a link type;

selecting a link numbering type;

selecting a link application;

selecting a sub layer interface type;

creating a first endpoint;

creating a second endpoint;

populating form panels with the link type, the link numbering type, the link application, and the sub layer interface type;

receiving user input of interfaces information;

validating the interfaces information;

creating a link in accordance with the interfaces information; and

provisioning the link.

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REMARKS/ARGUMENTS

Claims 1-16 are pending in the application. The Examiner has rejected claims 1-16. Applicant has added new claims 17 and 18. Applicant respectfully requests reconsideration of pending claims 1-18.

The Examiner characterizes Applicant's argument as being focused on the following:

(A) Hansen fails to teach "determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database."

(B) Hansen fails to teach "creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database and storing the new logical configuration link in the logical link database."

(C) Hansen fails to teach "selecting a link numbering type for the new logical configuration link."

The Examiner disagrees. With respect to the Examiner's characterization (A) above, the Examiner states, "Hansen teaches this limitation because it identifies the location of the configuration file, and the location could be on a local drive or on a network neighborhood. (see Hansen, column 5, lines 45-65) By doing that, Hansen determines whether the logical configuration links to a local database or a network database."

Applicant respectfully disagrees. Applicant notes the Examiner asserts the teachings of Hansen disjunctively identify a location of a configuration file as being either on a local drive or on a network neighborhood. However, Applicant notes "determining whether the local interface and next neighbor information" is recited conjunctively. Therefore, Applicant submits the purported teachings alleged by the Examiner with respect to the Examiner's characterization (A) above fail to disclose the subject matter recited in the claims.

With respect to the Examiner's characterization (B) above, the Examiner states, "Hansen teaches this limitation because the PCI slot 3, which is not connected or associated with any logical

configure, can be configured to be linked to a network device and configured according to device's information. (see Hansen, column 15, lines 40-60) By doing so, Hansen creates a new logical configuration on the PCI slot 3 when none existed before." The Examiner further states, "Hansen stores the new configured script in a memory subsystem, and the memory subsystem is a database for configuration scripts. (see Hansen, column 2, lines 40-45)." The Examiner also clarified confusion over the Examiner's statements concerning two different cited patents (U.S. Patents 6,772,204 and 5,838,907) issued to inventors named Hansen.

Applicant respectfully disagrees. While the Examiner asserted the teachings of Hansen disjunctively identified a location of a configuration file as being either on a local drive or on a network neighborhood, such assertion of the purported teachings of Hansen also implies that Hansen fails to disclose "creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database...." Thus, Applicant submits the rejections based on the purported teachings alleged by the Examiner with respect to the Examiner's characterization (B) cannot properly be maintained.

With respect to the Examiner's characterization (C) above, the Examiner states, "Hansen teaches this limitation because the new PCI is configured with desired port number and port setting. The selection of port number and setting is a selection of number link configuration. (see Hansen, col. 15, lines 40-45)."

Applicant respectfully disagrees. Applicant notes "Hansen [understood to refer to U.S. Patent 5,838,907], col. 15, lines 40-45)" states, "Specifically, for the Compaq router 122, PCI slot 1 has been used to provide a first ethernet connection 222, PCI slot 2, an HSSI connection 224 and PCI slot 4, a second ethernet 226. PCI slot 3, however, remains unconnected. From the backplane bitmap 220, the network administrator may view the settings for a port by double clicking on a selected port...." Applicant does not see the purported teaching of "the new PCI is configured with desired port number and port setting" in the cited portion of the cited reference. Thus, Applicant submits the rejections based on the purported teachings alleged by the Examiner with respect to the Examiner's characterization (C) cannot properly be maintained.

Applicant notes Applicant has also presented arguments as to the Hansen reference failing to disclose "an unnumbered type," modifying a logical configuration link in the logical link database,"

"deleting a logical configuration link in the logical link database," "a processing system coupled to the logical link database for accessing the logical link database," "...wherein the processing system determines local interface and next neighbor information for the network device," "...wherein the processing system determines whether the local interface and next neighbor information is associated with one of the logical configuration links stored in the logical link database," "...wherein the processing system creates a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links stored in the logical link database," "...wherein the processing system causes the new logical configuration link to be stored in the logical link database," "...wherein the processing system validates the new logical configuration link," and "...wherein the processing system causes the new logical configuration link to be sent to the network device." With respect to claims 5 and 6, Applicant has further presented arguments regarding the allowability of claims 5 and 6. However, the Examiner appears to have limited the Examiner's Response to Arguments to the Examiner's characterizations (A), (B), and (C), but does not appear to have responded to the Applicant's other previously presented arguments, as noted above. Thus, Applicant continues to contend that claims for which such arguments have been advanced are in condition for allowance.

The Examiner has rejected claims 1-4 and 7-16 under 35 U.S.C.§102(b) as being anticipated by Hansen (United States Patent No. 5,838,907). Applicant respectfully disagrees.

Regarding claim 1, Applicant has presented arguments for the allowability of claim 1 above in response to the Examiner's Response to Arguments. Therefore, Applicant submits claim 1 is in condition for allowance.

Regarding claim 2, Applicant has presented arguments for the allowability of claim 2 above in response to the Examiner's Response to Arguments. Therefore, Applicant submits claim 2 is in condition for allowance.

Regarding claim 3, Applicant has presented arguments for the allowability of claim 3 above in response to the Examiner's Response to Arguments. Thus, Applicant submits claim 3 is also in condition for allowance.

Regarding claim 4, Applicant has presented arguments for the allowability of claim 4 above in response to the Examiner's Response to Arguments. Therefore, Applicant submits claim 4 is in condition for allowance.

Regarding claim 7, Applicant has presented arguments for the allowability of claim 7 above in response to the Examiner's Response to Arguments. Thus, Applicant submits claim 7 is in condition for allowance.

Regarding claim 8, Applicant has presented arguments for the allowability of claim 8 above in response to the Examiner's Response to Arguments. Thus, Applicant submits claim 8 is in condition for allowance.

Regarding claim 9, Applicant has presented arguments for the allowability of claim 9 above in response to the Examiner's Response to Arguments. Thus, Applicant submits claim 9 is in condition for allowance.

Regarding claim 10, Applicant has presented arguments for the allowability of claim 10 above in response to the Examiner's Response to Arguments. Thus, Applicant submits claim 10 is also in condition for allowance.

Regarding claim 11, Applicant has presented arguments for the allowability of claim 11 above in response to the Examiner's Response to Arguments. Thus, Applicant submits claim 11 is in condition for allowance.

Regarding claim 12, Applicant has presented arguments for the allowability of claim 12 above in response to the Examiner's Response to Arguments. Thus, Applicant submits claim 12 is in condition for allowance.

Regarding claim 13, Applicant has presented arguments for the allowability of claim 13 above in response to the Examiner's Response to Arguments. Therefore, Applicant submits claim 13 is in condition for allowance.

Regarding claim 14, Applicant has presented arguments for the allowability of claim 14 above in response to the Examiner's Response to Arguments. Therefore, Applicant submits claim 14 is in condition for allowance.

Regarding claim 15, Applicant has presented arguments for the allowability of claim 15 above in response to the Examiner's Response to Arguments. Therefore, Applicant submits claim 15 is in condition for allowance.

Regarding claim 16, Applicant has presented arguments for the allowability of claim 16 above in response to the Examiner's Response to Arguments. Therefore, Applicant submits claim 16 is in condition for allowance.

The Examiner has rejected claim 5 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Hansen in view of Hansen (United States Patent No. 5,838,907), and further in view of Hardwick (United States Patent No. 5,550,816). Applicant respectfully disagrees.

Regarding claim 5, Applicant has presented arguments for the allowability of claim 5 above in response to the Examiner's Response to Arguments. Thus, Applicant submits claim 5 is in condition for allowance.

The Examiner has rejected claim 6 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Hansen (United States Patent No. 5,838,907) in view of Chui (United States Patent No. 2002/0165978). Applicant respectfully disagrees.

Regarding claim 6, Applicant has presented arguments for the allowability of claim 6 above in response to the Examiner's Response to Arguments. Thus, Applicant submits claim 6 is in condition for allowance.

In conclusion, Applicant has overcome all of the Office's rejections, and early notice of allowance to this effect is earnestly solicited. If, for any reason, the Office is unable to allow the Application on the next Office Action, and believes a telephone interview would be helpful, the Examiner is respectfully requested to contact the undersigned attorney.

Respectfully submitted,

01/24/2008
Date

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IFW

PTO/SB/21 (10-07)
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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	10/027,821
Filing Date	12-19-2001
First Named Inventor	Denis Proulx, et al.
Art Unit	2174
Examiner Name	Peng, Ke
Attorney Docket Number	1400.1374890
Total Number of Pages in This Submission	234

ENCLOSURES (Check all that apply)

- [ ] Fee Transmittal Form
  - [ ] Fee Attached
- [ ] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [x] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/ Incomplete Application
  - [ ] Reply to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) ______
  - [ ] Landscape Table on CD
- [ ] After Allowance Communication to TC
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to TC (Appeal Notice, Brief, Reply Brief)
- [ ] Proprietary Information
- [ ] Status Letter
- [x] Other Enclosure(s) (please identify below):

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Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	Ross D. Snyder & Associates, Inc.		
Signature	Ross D Snyder		
Printed name	Ross D. Snyder		
Date	01-31-2008	Reg. No.	37,730

CERTIFICATE OF TRANSMISSION/MAILING

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Signature	Terri Alloway		
Typed or printed name	Terri Alloway	Date	01-31-2008

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	10/027,821
Filing Date	12-19-2001
First Named Inventor	Denis Proulx et al.
Art Unit	2174
Examiner Name	Peng, Ke
Attorney Docket Number	1400.1374890

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US-2003/0097438	05-2003	Boarden et al.	
		US-6,791,981	09-2004	Novaes, Marcos N.	
		US-6,917,626	07-2005	Duvvury, Murali	
		US-6,516,345	02-2003	Kracht, James E.	
		US-6,895,433	05-2005	Slater et al.	
		US-2003/0154271	08-2003	Baldwin et al.	
		US-2002/0032761	03-2002	Aoyagi et al.	
		US-2002/0169884	11-2002	Jean et al.	
		US-5,835,720	11-1998	Nelson et al.	
		US-6,584,503	06-2003	Carney et al.	
		US-6,611,863	08-2003	Banginwar, Rajesh P.	
		US-6,377,987	04-2002	Kracht, James E.	
		US-7,136,357	11-2006	Soumiya et al.	
		US-6,061,505	05-09-2000	Pitchaikani et al.	
		US-6,912,587	06-2005	O'Neil, Joseph Thomas	
		US-6,891,793	05-2005	Suzuki et al.	
		US-6,570,867	05-2003	Robinson et al.	
		US-6,292,472 B1	09-18-2001	Rariden et al.	
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] -Number[4] -Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]
		EP 0 455 402 A2	06-11-1991	Hewlett-Packard		
		EP 0 772 318 A2	07-05-1997	Hewlett-Packard		
		EP 0 809 383 A2	11-26-1997	Sun Microsystems		
		WO 95/06989	03-09-1995	Cabletron Systems		
		WO 92/05485	04-02-1992	Cabletron Systems		
		EP 0 996 253 A2/A3	04-26-2000	Canon Kabushiki Kaisha		

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 2

Complete if Known	
Application Number	10/027,821
Filing Date	12-19-2001
First Named Inventor	Denis Proulx et al.
Art Unit	2174
Examiner Name	Peng, Ke
Attorney Docket Number	1400.1374890

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
		DUPUY ET AL.; Netmate: A Network Management Environment; article; 3-1991, IEEE Network Magazine; pgs. 35-43; 5(1991) March, No. 2, New York, US	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.
This collection of information is required by 37 CFR 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: **Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/027,821	12/19/2001	Denis Proulx	1400.1374890	9507

25697 7590 05/16/2008
ROSS D. SNYDER & ASSOCIATES, INC.
PO BOX 164075
AUSTIN, TX 78716-4075

EXAMINER	
KE, PENG	
ART UNIT	**PAPER NUMBER**
2174	
MAIL DATE	**DELIVERY MODE**
05/16/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No.	Applicant(s)
	10/027,821	PROULX ET AL.
	Examiner	Art Unit
	Peng Ke	2174

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 January 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☐ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5)☐ Notice of Informal Patent Application

6)☐ Other: _____.

DETAILED ACTION

This action is responsive to communications: Amendment, filed on 4/26/07.

Claims 1-18 are pending in this application. Claims 1 and 9 are independent claims.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-4, and 7-18 are rejected under 35 U.S.C. 102(b) as being anticipated by Hansen US Patent 5,838,907.

As per claim 1, Hansen teaches a network administration method for provisioning logical configuration links for at least two network devices through a dedicated graphical user interface form, the method comprising:

Selecting a network device having at least one network interface through the dedicated graphical user interface form; (figure 3b, column 15, lines 18-32; To configure a device, the device must be selected first)

Determining local interface and next neighbor information for the network device; (figure 7, items 114, 116, 120, 126, 122, 118, and 124)

Determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database; (column 5, lines 35-65; Subsystem is a logical link database)

Creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical ink databases; (column 15, lines 30-50; Unconnected PCI slot are unassociated connection)

Storing the new logical configuration link in the logical link database; (column 13, lines 10-30)

Validating the new logical configuration link; (column 13, lines 10-30)

Sending the new logical configuration link to the network device; (column 14, lines 41-60) and

Displaying a graphical representation of the new logical configuration link on a display device. (column 14, lines 41-60)

As per claim 2, Hansen teaches the method of claim 1. Hansen further teaches the step of creating a new logical configuration lik further comprises the steps of ;

Selecting a like type; (column 13, lines 1-10; x. 25, frame relay, PPP and HDLC are link types)

Selecting a link numbering type for the new logical configuration link; (column 11, lines 13-30; PCI slots are numbered configuration links)

Selecting a link application for the new logical configuration link; (column 14, lines 5-25; The script commands are applications; column 13, lines 65-column 14, lines 5)

Selecting a sub layer interface type for the new logical configuration link; (column 14, lines 15-25; Connection identifiers are configuration links)

Creating a first endpoint for the new logical configuration link; and

Creating a second endpoint for the new logical configuration link.(column 13, lines 10-30)

As per claim 3, Hansen teaches the method of claim 2, wherein the step of selecting the link type further comprises the step of:

Selecting the link type from among a group consisting of: point-to-point, point-to-IP, and pint-to-subnet. (column 13, lines 1-10; x. 25, frame relay, PPP and HDLC)

As per claim 4, Hansen teaches the method of claim 4, wherein the step of selecting the a link number type further comprises the step of:

Selecting the link numbering type from a group consisting of: a numbered type and an un-number type. (column 11, lines 13-30; PCI slots are numbering type, column 13, lines 28-45; a list of connection interface is un-number type)

As per claim 7, Hansen teaches the method of claim 1, Hansen further teaches the step of:

Modifying a logical configuration link in the logical link databases. (column 11, lines 41-53; Editing is modifying)

As per claim 8, Hansen teaches the method of claim 1, Hansen further teaches the step of:

Deleting a logical configuration link in the logical link database. (column 10, lines 1-20)

As per claim 9, it is of the same scope as claim 1. Supra.

As per claim 10, Hansen teaches the apparatus of claim 9. Hansen teaches wherein the display device provides an ability to select a network device having at least one network

interface through the graphical user interface form. (figure 3b, column 15, lines 18-32; To configure a device, the device must be selected first)

As per claim 11, Hansen teaches the apparatus of claim 9, Hansen further teaches the processing system determines local interface and next neighbor information for the network device. (figure 7, items 114, 116, 120, 126, 122, 118, and 124)

As per claim 12, Hansen teaches the apparatus of claim 11, Hansen further teaches the processing system determines whether the local interface and next neighbor information is associated with one of the logical configuration links stored in the logical link database. (column 15, lines 30-50; Unconnected PCI slot are unassociated connection)

As per claim 13, Hansen teaches the apparatus of claim 12, Hansen further teaches creates a new logical configuration link when the local interface and next neighbor information is not associate with any of the logical configuration links stored in the logical link database. (column 13, lines 10-30)

As per claim 14, Hansen teaches the apparatus of claim 13, Hansen further teaches the processing system causes the new logical configuration link to be stored in the logical link database. (column 13, lines 10-30)

As per claim 15, Hansen teaches the apparatus of claim 14, Hansen further teaches the processing system validates the new logical configuration link. (column 13, lines 10-30)

As per claim 16, Hansen teaches the apparatus of claim 15, Hansen further teaches the processing system cause the new logical configuration link to be sent to the network device. (column 14, lines 41-60)

As per claim 17, it is rejected under the same rationale as claim 1. Supra.

As per claim 18, it is rejected under the same rationale as claim 2. Supra.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hansen in view of Hansen US Patent 5,838,907 in view of Hardwick US Patent 5,550,816.

As per claim 5, Hansen teaches the method of claim 2. Hansen fails to teach the step of selecting a link application from a group consisting of:

Internet Protocol Forwarding, Multi-Protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching.

Hardwick teaches the step of selecting a link application from a group consisting of:

Internet Protocol Forwarding, Multi-Protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching. (column 43, lines 60- column 44, lines 5)

It would have been obvious to an artisan at the time of the invention to include Hardwick's teaching with method of Hansen in order to provide a wide variety of access control tools that permit network managers to define the policy of how network group can interact within themselves.

Claims 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hansen in view of Hansen US Patent 5,838,907 in view of Chui US Patent 2002/0165978.

As per claim 6, Hansen teaches the method of claim 2, Hansen fails to teach selecting a sub layer interface type further comprises the step of :

Selecting the sub-layer interface type from a group consisting of; Packet over Sonet, Asynchronous Transfer Mode, and GigEthernet.

Chui teaches selecting a sub layer interface type further comprises the step of :

Selecting the sub-layer interface type from a group consisting of; Packet over Sonet, Asynchronous Transfer Mode, and GigEthernet. (Paragraph 0201)

It would have been obvious to an artisan at the time of the invention to include Chui's teaching with method of Hansen in order to provide a wide variety of access control tools that permit network managers to define the policy of how network group can interact within themselves.

Response to Argument

Applicant's arguments filed on 4/26/07 have been fully considered but they are not persuasive.

Applicant's argument focused on the following:

A) Hansen fails to teach "determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database."

B) Hansen fails to teach "creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration

links in the logical link database and storing the new logical configuration link in the logical link database."

C) Hansen fails to teach "selecting a link numbering type for the new logical configuration link."

Examiner disagrees.

A) Hansen system relates to both the local interface and next neighbor information by using a map editor and a configuration which are local interface (see Hansen col. 5, lines 35-45) and displaying on this interface information regarding neighboring network device. (see Hansen col. 5, lines 55-65)

B) Hansen teaches this limitation because the PCI slot 3, which is not connected or associated with any logical configure, can be configured to be linked to a network device and configured according to device's information. (see Hansen, column 15 ,lines 40-60) By doing so, Hansen creates a new logical configuration on the PCI slot 3 when none existed before. Furthermore, Hansen stores the newly configured script in a memory subsystem, and the memory subsystem is a database for configuration scripts. (see Hansen, column 2 ,lines 40-45) Furthermore, upon completion, the new neighbor device information is displayed on the local interface. (see Hansen, col. 17, lines 40-col. 18, line 2)

C) Hansen teaches this limitation because the new PCI is configured with desired port number and port setting. (see Hansen, col. 15, lines 5-20) The new PCI is configured with new IP address for the specified port. (see Hansen, figure 5, items 202; col. 13, lines 45-col. 14, lines 40; the desired IP setting are set to the select port.)

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Peng Ke whose telephone number is (571) 272-4062. The examiner can normally be reached on M-Th and Alternate Fridays 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kristine L. Kincaid can be reached on (571) 272-4063. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Peng Ke

/Peng Ke/
Primary Examiner, Art Unit 2174

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

Complete If Known	
Application Number	10/027,821
Filing Date	12-19-2001
First Named Inventor	Denis Proulx et al.
Art Unit	2174
Examiner Name	Peng, Ke
Attorney Docket Number	1400.1374890

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
/PK/		US-2003/0097438	05-2003	Bearden et al.	
		US-6,791,981	09-2004	Novaes, Marcos N.	
		US-6,917,626	07-2005	Duvvury, Murali	
		US-6,516,345	02-2003	Kracht, James E.	
		US-6,895,433	05-2005	Slater et al.	
		US-2003/0154271	08-2003	Baldwin et al.	
		US-2002/0032761	03-2002	Aoyagi et al.	
		US-2002/0169884	11-2002	Jean et al.	
		US-5,835,720	11-1998	Nelson et al.	
		US-6,584,503	06-2003	Carney et al.	
		US-6,611,863	08-2003	Banginwar, Rajesh P.	
		US-6,377,987	04-2002	Kracht, James E.	
		US-7,136,357	11-2006	Soumiya et al.	
		US-6,061,505	05-09-2000	Pitchaikani et al.	
		US-6,912,587	06-2005	O'Neil, Joseph Thomas	
		US-6,891,793	05-2005	Suzuki et al.	
		US-6,570,867	05-2003	Robinson et al.	
		US-6,292,472 B1	09-18-2001	Rariden et al.	
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] -Number[4] -Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]
/PK/		EP 0 455 402 A2	06-11-1991	Hewlett-Packard		
		EP 0 772 318 A2	07-05-1997	Hewlett-Packard		
		EP 0 809 383 A2	11-26-1997	Sun Microsystems		
		WO 95/06989	03-09-1995	Cabletron Systems		
		WO 92/05485	04-02-1992	Cabletron Systems		
		EP 0 996 253 A2/A3	04-26-2000	Canon Kabushiki Kaisha		

Examiner Signature	/Peng Ke/	Date Considered	05/10/2008

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /PK/

PTO/SB/08B (10-07)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Complete if Known	
Application Number	10/027,821
Filing Date	12-19-2001
First Named Inventor	Denis Proulx et al.
Art Unit	2174
Examiner Name	Peng, Ke
Attorney Docket Number	1400.1374890

Sheet 2 of 2

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
/PK/		DUPUY ET AL.; Netmate: A Network Management Environment; article; 3-1991, IEEE Network Magazine; pgs. 35-43; 5(1991) March, No. 2, New York, US	

Examiner Signature	/Peng Ke/	Date Considered	05/10/2008

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.
This collection of information is required by 37 CFR 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: **Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /PK/

OIPE IAP57 NOV 20 2008 PATENT & TRADEMARK OFFICE

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PTO/SB/21 (08-08)
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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	10/027,821
Filing Date	12-19-2001
First Named Inventor	Denis Proulx, et al.
Art Unit	2174
Examiner Name	Ke, Peng
Attorney Docket Number	1400.1374890
Total Number of Pages in This Submission	19

ENCLOSURES *(Check all that apply)*

- [x] Fee Transmittal Form
  - [x] Fee Attached
- [x] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [x] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/ Incomplete Application
  - [ ] Reply to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) ______
  - [ ] Landscape Table on CD
- [ ] After Allowance Communication to TC
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to TC (Appeal Notice, Brief, Reply Brief)
- [ ] Proprietary Information
- [ ] Status Letter
- [x] Other Enclosure(s) (please Identify below):

Return Receipt Post Card

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	Ross D. Snyder & Associates, Inc.
Signature	Ross D. Snyder
Printed name	Ross D. Snyder
Date	11-17-2008
Reg. No.	37,730

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature	Ross D. Snyder		
Typed or printed name	Ross D. Snyder, Reg. No. 37,730	Date	11-17-2008

PTO/SB/22 (08-08)
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PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a) FY 2008 *(Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).)*	Docket Number (Optional) 1400.1374890
Application Number 10/027,821	Filed 12-19-2001
For METHOD AND SYSTEM FOR IP LINK MANAGEMENT	
Art Unit 2174	Examiner Ke, Peng

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

	Fee	Small Entity Fee	
☐ One month (37 CFR 1.17(a)(1))	$120	$60	$
☐ Two months (37 CFR 1.17(a)(2))	$460	$230	$
☑ Three months (37 CFR 1.17(a)(3))	$1050	$525	$ 1,110.00
☐ Four months (37 CFR 1.17(a)(4))	$1640	$820	$
☐ Five months (37 CFR 1.17(a)(5))	$2230	$1115	$

☐ Applicant claims small entity status. See 37 CFR 1.27.

☑ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

11/20/2008 KGEBREM1 00000009 10027821

☐ The Director has already been authorized to charge fees in this application to a Deposit Account. 01 FC:1253 1110.00 OP

☑ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 50-1566. I have enclosed a duplicate copy of this sheet.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the ☐ applicant/inventor.

☐ assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) is enclosed (Form PTO/SB/96).

☑ attorney or agent of record. Registration Number 37,730

☐ attorney or agent under 37 CFR 1.34.
Registration number if acting under 37 CFR 1.34 ____________

Ross D. Snyder (signature) — Signature | 11-17-2008 — Date

Ross D. Snyder — Typed or printed name | 512-347-9223 — Telephone Number

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.

☐ Total of ____________ forms are submitted.

OIPE IAP57 NOV 20 2008

PTO/SB/17 (10-07)
Approved for use through 06/30/2010. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

Effective on 12/08/2004.
Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2008

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT (\$) 1,110.00

Complete if Known	
Application Number	10/027,821
Filing Date	12-19-2001
First Named Inventor	Denis Proulx et al.
Examiner Name	Ke, Peng
Art Unit	2174
Attorney Docket No.	1400.1374890

METHOD OF PAYMENT (check all that apply)

☑ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): ______

☑ Deposit Account Deposit Account Number: 50-1566 Deposit Account Name: Ross D. Snyder & Assoc.

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☑ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, except for the filing fee

☑ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 ☑ Credit any overpayments

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

Application Type	FILING FEES Fee (\$)	Small Entity Fee (\$)	SEARCH FEES Fee (\$)	Small Entity Fee (\$)	EXAMINATION FEES Fee (\$)	Small Entity Fee (\$)	Fees Paid (\$)
Utility	310	155	510	255	210	105	
Design	210	105	100	50	130	65	
Plant	210	105	310	155	160	80	
Reissue	310	155	510	255	620	310	
Provisional	210	105	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee (\$)	Small Entity Fee (\$)
Each claim over 20 (including Reissues)	50	25
Each independent claim over 3 (including Reissues)	210	105
Multiple dependent claims	370	185

Total Claims ____ - 20 or HP = Extra Claims ____ x Fee (\$) ____ = Fee Paid (\$) ____

HP = highest number of total claims paid for, if greater than 20.

Multiple Dependent Claims Fee (\$) ____ Fee Paid (\$) ____

Indep. Claims ____ - 3 or HP = Extra Claims ____ x Fee (\$) ____ = Fee Paid (\$) ____

HP = highest number of independent claims paid for, if greater than 3.

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is \$260 (\$130 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets ____ - 100 = Extra Sheets ____ / 50 = Number of each additional 50 or fraction thereof ____ (round up to a whole number) x Fee (\$) ____ = Fee Paid (\$) ____

4. OTHER FEE(S) Fees Paid (\$)

Non-English Specification, \$130 fee (no small entity discount) ____

Other (e.g., late filing surcharge): Extension Fee 1,110.00

SUBMITTED BY

Signature	Registration No. (Attorney/Agent) 37,730	Telephone 512-347-9223
Name (Print/Type) Ross D. Snyder		Date 11-17-2008

This collection of information is required by 37 CFR 1.136. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Denis Proulx, et al.

Title: METHOD AND SYSTEM FOR IP LINK MANAGEMENT

App. No.: 10/027,821 Filed: 12-19-2001

Examiner: Ke, Peng Group Art Unit: 2174

Atty. Dkt. No. 1400.1374890

Mail Stop Amendment
Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

RESPONSE

Dear Sir:

In response to the Office action of May 16, 2008, Applicant submits the following response:

In the Claims:

1. (Original) A network administration method for provisioning logical configuration links for at least two network devices through a dedicated graphical user interface form, the method comprising:

selecting a network device having at least one network interface through the dedicated graphical user interface form;

determining local interface and next neighbor information for the network device;

determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database;

creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database;

storing the new logical configuration link in the logical link database;

validating the new logical configuration link;

sending the new logical configuration link to the network device; and

displaying a graphical representation of the new logical configuration link on a display device.

2. (Original) The method of claim 1, wherein the step of creating a new logical configuration link further comprises the steps of:

selecting a link type;

selecting a link numbering type for the new logical configuration link;

selecting a link application for the new logical configuration link;

selecting a sub layer interface type for the new logical configuration link;

creating a first endpoint for the new logical configuration link; and

creating a second endpoint for the new logical configuration link.

3. (Original) The method of claim 2, wherein the step of selecting the link type further comprises the step of:

selecting the link type from among a group consisting of: point-to-point, point-to-IP, and point-to-subnet.

4. (Original) The method of claim 2, wherein the step of selecting a link numbering type further comprises the step of:

selecting the link numbering type from a group consisting of: a numbered type and an unnumbered type.

5. (Original) The method of claim 2, wherein the step of selecting a link application further comprises the step of:

selecting the link application from a group consisting of: Internet Protocol Forwarding, Multi-Protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching.

6. (Original) The method of claim 2, wherein the step of selecting a sub layer interface type further comprises the step of:

selecting the sub layer interface type from a group consisting of: Packet Over Sonet, Asynchronous Transfer Mode, and GigEthernet.

7. (Original) The method of claim 1, further comprising the step of:

modifying a logical configuration link in the logical link database.

8. (Original) The method of claim 1, further comprising the step of:

deleting a logical configuration link in the logical link database.

9. (Original) Apparatus for provisioning logical configuration links comprising:

a logical link database for storing logical configuration links;

a processing system coupled to the logical link database for accessing the logical link database; and

a display device coupled to the processing system for displaying a graphical user interface form comprising a graphical representation of a logical configuration link.

10. (Original) The apparatus of claim 9 wherein the display device provides an ability to select a network device having at least one network interface through the graphical user interface form.

11. (Original) The apparatus of claim 9 wherein the processing system determines local interface and next neighbor information for the network device.

12. (Original) The apparatus of claim 11 wherein the processing system determines whether the local interface and next neighbor information is associated with one of the logical configuration links stored in the logical link database.

13. (Original) The apparatus of claim 12 wherein the processing system creates a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links stored in the logical link database.

14. (Original) The apparatus of claim 13 wherein the processing system causes the new logical configuration link to be stored in the logical link database.

15. (Original) The apparatus of claim 14 wherein the processing system validates the new logical configuration link.

16. (Original) The apparatus of claim 15 wherein the processing system causes the new logical configuration link to be sent to the network device.

17. (Previously Presented) The method of claim 1 wherein creating the new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database occurs based on interfaces information entered by a user.

18. (Previously Presented) A method comprising:

selecting a link type;

selecting a link numbering type;

selecting a link application;

selecting a sub layer interface type;

creating a first endpoint;

creating a second endpoint;

populating form panels with the link type, the link numbering type, the link application, and the sub layer interface type;

receiving user input of interfaces information;

validating the interfaces information;

creating a link in accordance with the interfaces information; and

provisioning the link.

REMARKS/ARGUMENTS

Claims 1-18 are pending in the application. The Examiner has rejected claims 1-18. Applicant respectfully requests reconsideration of pending claims 1-18.

The Examiner has rejected claims 1-4 and 7-16 under 35 U.S.C. §102(b) as being anticipated by Hansen (United States Patent No. 5,838,907). Applicant respectfully disagrees.

Regarding claim 1, Applicant submits the cited portions of the cited reference fail to disclose the subject matter of claim 1. As an example, Applicant submits the cited portions of the cited reference fail to disclose "determining local interface and next neighbor information for the network device." The Examiner cites "(figure 7, items 114, 116, 120, 126, 122, 118, and 124)" of the Hansen reference as allegedly disclosing such feature. However, Applicant notes Figure 7 of the Hansen reference merely purports to be an illustration of a configuration manager GUI, but does not appear to disclose any method steps.

As another example, Applicant submits the cited portions of the cited reference fail to disclose "determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database." While the Examiner cites "(column 5, lines 35-64; Subsystem is a logical link database)," Applicant notes the cited portion of the cited reference states, "The data and programming instruction are stored in the memory subsystem 6...," Applicant sees no teaching as to "determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database."

As yet another example, Applicant submits the cited portions of the cited reference fail to disclose "creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database." While the Examiner cites "(column 15, lines 30-50; Unconnected PCI slot are unassociated connection), Applicant notes col. 15, lines 33-39, state, "As may now be seen, the various network entities, as well as unconnected connection interfaces, are graphically displayed on the backplane bitmap 220 using information contained in the bitmap section 36 of the configuration script 12-N and the local configuration file 20 for the Compaq router 122." However, col. 5, lines 49-52, as the Examiner cited in alleging "Subsystem is a logical link database," states "If a particular network device

does not have a configuration script, a configuration file cannot be constructed by the network device configuration tool 10." Accordingly, Applicant submits the Examiner's apparent interpretation of the teachings of the prior art would appear to render them inoperable. Thus, Applicant submits the cited portions of the cited reference cannot disclose the subject matter recited in claim 1.

As yet another example, Applicant submits the cited portions of the cited reference fail to disclose "storing the new logical configuration link in the logical link database." While the Examinuer cites "(column 13, lines 10-30);" Applicant submits col. 13, lines 22-26, state, "If either the origination or destination device or entity do not have an available slot which is connectable to the other device or entity, a determination is made at step 156 that the devices/entities cannot be connected." Applicant submits the cited portion of the cited reference fails to disclose "storing the new logical configuration link in the logical link database."

As a further example, Applicant submits the cited portions of the cited reference fail to disclose "sending the new logical configuration link to the network device." While the Examiner cites "(column 14, lines 41-60)," Applicant notes col. 14, lines 48-50, states "...before saving the constructed local configuration file 20 to the memory subsystem and associating it with the device." Applicant submits the cited portion of the cited reference does not appear to disclose "sending the new logical configuration link to the network device." Therefore, Applicant submits claim 1 is in condition for allowance.

Regarding claim 2, Applicant submits the cited portions of the cited reference fail to disclose "selecting a link type." While the Examiner cites "(column 13, lines 1-10; x.25, frame relay, PPP and HDLC are link types," Applicant submits the Examiner has alleged, with respect to claim 1, from which claim 2 depends, that "Subsystem is a logical link database." Applicant submits the Examiner doesn't provide any evidence that "Subsystem" includes any information pertaining to "frame relay, PPP and HDLC." Thus, Applicant submits the Examiner's apparent interpretation of the teachings of the prior art would appear to render them inoperable.

As another example, Applicant submits the cited portions of the cited reference fail to disclose "selecting a link numbering type for the new logical configuration link." While the Examiner alleges "(column 11, lines 13-30; PCI slots are numbered configuration links)," Applicant submits such allegation does not disclose a step of "selecting a link numbering type...."

As a further example, Applicant submits the cited portions of the cited reference fail to disclose "selecting a link application for the new logical configuration link." While the Examiner alleges "(column 14, lines 5-25; The script commands are applications; column 13, lines 65-column 14, lines 5)," Applicant notes the Examiner alleged with respect to "creating a new logical configuration link..." of claim 1, from which claim 2 depends, "Unconnected PCI slot are unassociated connection." While the Examiner alleges "The script commands are applications," Applicant sees no allegation by the Examiner that "the script commands" are disclose link applications for "unconnected PCI slot," which the Examiner appears to allege disclose "the new logical configuration link." Thus, Applicant submits the Examiner's allegations appear to be inconsistent and would render the purported teachings of the cited reference inoperable.

As yet another example, Applicant submits the cited portions of the cited reference fail to disclose "selecting a sub layer interface type for the new logical configuration link." While the Examiner cites "(column 14, lines 15-25; Connection identifiers are configuration links)," Applicant notes the Examiner alleged, with respect to "creating a new logical configuration link" of claim 1, from which claim 2 depends, "Unconnected PCI slot are unassociated connection." Thus, Applicant submits "connection identifiers are configuration links" is inconsistent with the purported teachings alleged by the Examiner with respect to claim 1, thereby apparently rendering such teachings inoperable. Moreover, Applicant submits "connection identifiers are configuration links" fails to disclose "selecting a sub layer interface type...."

As yet another example, Applicant submits the cited portions of the cited reference fail to disclose "creating a first endpoint for the new logical configuration link" and "creating a second endpoint for the new logical configuration link." While the Examiner cites "(column 13, lines 10-30)," Applicant submits col. 13, lines 22-26, state, "If either the origination or destination device or entity do not have an available slot which is connectable to the other device or entity, a determination is made at step 156 that the devices/entities cannot be connected." Applicant submits the cited portion of the cited reference fails to disclose "creating a first endpoint for the new logical configuration link" and "creating a second endpoint for the new logical configuration link." Therefore, Applicant submits claim 2 is in condition for allowance.

Regarding claim 3, Applicant submits fails to disclose "selecting the link type from among a group consisting of: point-to-point, point-to-IP, and point-to-subnet." While the Examiner cites

"(column 13, lines 1-10; x.25, frame relay, PPP and HDLC)," Applicant notes the inconsistency Applicant alleges with respect to the Examiner's allegations regarding "selecting a link type" in claim 2, from which claim 3 depends. Thus, Applicant submits the Examiner's allegations with respect to claim 3 also render the Examiner's apparent interpretation of the purported teachings of the cited portions of the cited reference inoperable. Therefore, Applicant submits claim 3 is also in condition for allowance.

Regarding claim 4, Applicant submits the cited portions of the cited reference fail to disclose "selecting the link numbering type from a group consisting of: a numbered type and an unnumbered type." While the Examiner cites "column 11, lines 13-30; PCI slots are numbering type, column 13, lines 28-45; a list of connection interface is un-number type)," Applicant notes the inconsistency Applicant alleges with respect to the Examiner's allegations regarding "selecting a link numbering type..." in claim 2, from which claim 4 depends. Thus, Applicant submits the Examiner's allegations with respect to claim 4 also render the Examiner's apparent interpretation of the purported teachings of the cited portions of the cited reference inoperable. Therefore, Applicant submits claim 4 is in condition for allowance.

Regarding claim 7, Applicant submits the cited portions of the cited reference fail to disclose "modifying a logical configuration link in the logical link database." While the Examiner cites "(column 11, lines 41-53; Editing is modifying)," Applicant notes the Examiner alleged "Unconnected PCI are unassociated connection" as purportedly teaching "creating a new logical configuration link..." in claim 1, from which claim 7 depends. Applicant sees no reference to such "unconnected PCI" in "(column 11, lines 41-53; Editing is modifying)," as alleged by the Examiner. Thus, Applicant submits the cited portions of the cited reference fail to disclose the subject matter of claim 7. Therefore, Applicant submits claim 7 is in condition for allowance.

Regarding claim 8, Applicant submits the cited portions of the cited reference fail to disclose "deleting a logical configuration link in the logical link database." While the Examiner cites "(column 10, lines 1-20)," Applicant notes the Examiner alleged "Unconnected PCI are unassociated connection" as purportedly teaching "creating a new logical configuration link..." in claim 1, from which claim 8 depends. Applicant sees no reference to such "unconnected PCI" in "(column 10, lines 1-20)," as alleged by the Examiner. Moreover, Applicant submits teachings in "(column 10, lines 1-20)" appear to be inconsistent with "unconnected PCI." For example, "telnet to this device," "view ip addresses,"

and "view ipx addresses" appear to be inconsistent with "unconnected PCI," as cited by the Examiner with respect to claim 1, from which claim 8 depends. Thus, Applicant submits the cited portions of the cited reference fail to disclose the subject matter of claim 8. Therefore, Applicant submits claim 8 is in condition for allowance.

Regarding claim 9, Applicant notes the Examiner states "As per claim 9, it is of the same scope as claim 1. Supra." Applicant respectfully disagrees and notes claim 9 is directed to different subject matter than claim 1. However, to the extent the Examiner relies on the Examiner's rejection of claim 1 to also reject claim 9, Applicant reiterates what Applicant alleges to be the deficiencies of the Examiner's rejection of claim 1, as Applicant discussed above. Therefore, Applicant submits claim 9 is in condition for allowance.

Regarding claim 10, Applicant has presented arguments for the allowability of claim 9, from which claim 10 depends. Therefore, Applicant submits claim 10 is also in condition for allowance.

Regarding claim 11, Applicant submits the cited portions of the cited reference fail to disclose "wherein the processing system determines local interface and next neighbor information for the network device." While the Examiner cites "(figure 7, items 114, 116, 120, 126, 122, 118, and 124), Applicant submits Figure 7 of the Hansen reference merely purports to be an illustration of a configuration manager GUI, but does not appear to disclose "wherein the processing system determines local interface and next neighbor information for the network device." Therefore, Applicant submits claim 11 is in condition for allowance.

Regarding claim 12, Applicant submits the cited portions of the cited reference fail to disclose "wherein the processing system determines whether the local interface and next neighbor information is associated with one of the logical configuration links stored in the logical link database." While the Examiner cites "(column 15, lines 30-50; Unconnected PCI slot are unassociated connection)," Applicant submits the "Unconnected PCI slot are unassociated connection" alleged by the Examiner fails to disclose, for example, "next neighbor information" and "the logical link database." Thus, Applicant submits the Examiner has not made a *prima facie* showing of anticipation with respect to the subject matter of claim 12. Therefore, Applicant submits claim 12 is in condition for allowance.

Regarding claim 13, Applicant submits the cited portions of the cited reference fail to disclose "wherein the processing system creates a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links stored in the logical link database." While the Examiner cites "(column 13, lines 10-30)," Applicant submits col. 13, lines 22-26, state, "If either the origination or destination device or entity do not have an available slot which is connectable to the other device or entity, a determination is made at step 156 that the devices/entities cannot be connected." Applicant submits the cited portion of the cited reference fails to disclose "wherein the processing system creates a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links stored in the logical link database." Therefore, Applicant submits claim 13 is in condition for allowance.

Regarding claim 14, Applicant submits the cited portions of the cited reference fail to disclose "wherein the processing system causes the new logical configuration link to be stored in the logical link database." While the Examiner cites "(column 13, lines 10-30)," Applicant submits col. 13, lines 22-26, state, "If either the origination or destination device or entity do not have an available slot which is connectable to the other device or entity, a determination is made at step 156 that the devices/entities cannot be connected." Applicant submits the cited portion of the cited reference fails to disclose "wherein the processing system causes the new logical configuration link to be stored in the logical link database." Therefore, Applicant submits claim 14 is in condition for allowance.

Regarding claim 15, Applicant has presented arguments for the allowability of claim 9, from which claim 15 indirectly depends. Therefore, Applicant submits claim 15 is in condition for allowance.

Regarding claim 16, Applicant submits the cited portions of the cited reference fail to disclose "wherein the processing system causes the new logical configuration link to be sent to the network device." While the Examiner cites "(column 14, lines 41-60)," Applicant notes col. 14, lines 48-50, states "...before saving the constructed local configuration file 20 to the memory subsystem and associating it with the device." Applicant submits the cited portion of the cited reference does not appear to disclose "wherein the processing system causes the new logical configuration link to be sent to the network device." Therefore, Applicant submits claim 16 is in condition for allowance.

Regarding claim 17, Applicant submits the cited portions of the cited reference fail to disclose "wherein creating the new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database occurs based on interfaces information entered by a user." The Examiner states "As per claim 17, it is rejected under the same rationale as claim 1. Supra." Applicant respectfully disagrees and notes claim 17 is directed to different subject matter than claim 1. However, to the extent the Examiner relies on the Examiner's rejection of claim 1 to also reject claim 17, Applicant reiterates what Applicant alleges to be the deficiencies of the Examiner's rejection of claim 1, as Applicant discussed above. Therefore, Applicant submits claim 17 is in condition for allowance.

Regarding claim 18, Applicant submits the cited portions of the cited reference fail to disclose the subject matter recited in claim 18. Applicant notes the Examiner states "As per claim 18, it is rejected under the same rationale as claim 2." Applicant respectfully disagrees and notes claim 18 is directed to different subject matter than claim 2. To the extent the Examiner relies on the Examiner's rejection of claim 2 to also reject claim 18, Applicant reiterates what Applicant alleges to be the deficiencies of the Examiner's rejection of claim 2, as Applicant discussed above. Nonetheless, Applicant submits the Examiner has not alleged anticipation with respect to subject matter recited in claim 18. As one example, Applicant submits claim 18 recites "populating form panels with the link type, the link numbering type, the link application, and the sub layer interface type," while claim 2 does not. As another example, Applicant submits claim 18 recites "receiving user input of interfaces information." As yet another example, Applicant submits claim 18 recites "validating the interfaces information." As a further example, Applicant submits claim 18 recites "creating a link in accordance with the interfaces information." As another example, Applicant submits claim 18 recites "provisioning the link." Applicant submits the Examiner has not alleged any teaching as to such subject matter. Thus, Applicant submits the Examiner has not made a *prima facie* showing of anticipation with respect to claim 18. Therefore, Applicant submits claim 18 is in condition for allowance.

The Examiner has rejected claim 5 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Hansen in view of Hansen (United States Patent No. 5,838,907), and further in view of Hardwick (United States Patent No. 5,550,816). Applicant respectfully disagrees.

Regarding claim 5, Applicant submits the cited portions of the cited reference fail to render unpatentable the subject matter of claim 5. As an example, Applicant submits the cited portions of the cited reference fail to disclose or suggest "selecting the link application from a group consisting of: Internet Protocol Forwarding, Multi-Protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching." Applicant notes the Examiner alleges, with respect to claim 2, from which claim 5 depends, "The script commands are applications." However, the Examiner now alleges "Hardwick teaches the step of selecting a link application from a group consisting of: Internet Protocol Forwarding, Multi-Protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching (column 43, lines 60-column 44, lines 5)." Applicant submits the Examiner's allegations as to purported teachings of the cited references with respect to the subject matter of claims 2 and 5 are inconsistent and contradictory, thereby rendering the supposed combination of the purported teachings inoperable. Moreover, Applicant submits the Examiner's alleged motivation to combine the references does not appear to pertain to the supposed combination of the purported teachings. Thus, Applicant submits the Examiner has not made a *prima facie* showing of obviousness with respect to the subject matter of claim 5. Therefore, Applicant submits claim 5 is in condition for allowance.

The Examiner has rejected claim 6 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Hansen in view of Hansen (United States Patent No. 5,838,907) in view of Chui (United States Patent No. 2002/0165978). Applicant respectfully disagrees.

Regarding claim 6, Applicant submits the cited portions of the cited reference fail to render unpatentable the subject matter of claim 6. As an example, Applicant submits the cited portions of the cited reference fail to disclose or suggest "selecting the sub layer interface type from a group consisting of: Packet Over Sonet, Asynchronous Transfer Mode, and GigEthernet." Applicant notes the Examiner alleges, with respect to claim 2, from which claim 6 depends, "Connection identifiers are configuration links." However, the Examiner now alleges "Chui teaches selecting a sub layer interface type comprises the step of: Selecting the sub-layer interface type from a group consisting of: Packet over Sonet, Asynchronous Transfer Mode, and GigEthernet." Applicant submits the Examiner's allegations as to purported teachings of the cited references with respect to the subject matter of claims 2 and 6 are inconsistent and contradictory, thereby rendering the supposed combination of the purported teachings inoperable. Moreover, Applicant submits the Examiner's alleged motivation to

combine the references does not appear to pertain to the supposed combination of the purported teachings. Thus, Applicant submits the Examiner has not made a *prima facie* showing of obviousness with respect to the subject matter of claim 6. Therefore, Applicant submits claim 6 is in condition for allowance.

In conclusion, Applicant has overcome all of the Office's rejections, and early notice of allowance to this effect is earnestly solicited. If, for any reason, the Office is unable to allow the Application on the next Office Action, and believes a telephone interview would be helpful, the Examiner is respectfully requested to contact the undersigned attorney.

Respectfully submitted,

11-17-2008

Date

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No.	Applicant(s)
	10/027,821	PROULX ET AL.
	Examiner	Art Unit
	SIMON KE	2174

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 November 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

This action is responsive to communications: Amendment, filed on 11/20/08.

Claims 1-18 are pending in this application. Claims 1 and 9 are independent claims.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-4, and 7-18 are rejected under 35 U.S.C. 102(b) as being anticipated by Hansen US Patent 5,838,907.

As per claim 1, Hansen teaches a network administration method for provisioning logical configuration links for at least two network devices through a dedicated graphical user interface form, the method comprising:

Selecting a network device having at least one network interface through the dedicated graphical user interface form; (figure 3b, column 15, lines 18-32; To configure a device, the device must be selected first)

Determining local interface and next neighbor information for the network device; (figure 7, items 114, 116, 120, 126, 122, 118, and 124)

Determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database; (column 5, lines 35-65; Subsystem is a logical link database)

Creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical ink databases; (column 15, lines 30-50; Unconnected PCI slot are unassociated connection)

Storing the new logical configuration link in the logical link database; (column 13, lines 10-30)

Validating the new logical configuration link; (column 13, lines 10-30)

Sending the new logical configuration link to the network device; (column 14, lines 41-60) and

Displaying a graphical representation of the new logical configuration link on a display device. (column 14, lines 41-60)

As per claim 2, Hansen teaches the method of claim 1. Hansen further teaches the step of creating a new logical configuration lik further comprises the steps of ;

Selecting a like type; (column 13, lines 1-10; x. 25, frame relay, PPP and HDLC are link types)

Selecting a link numbering type for the new logical configuration link; (column 11, lines 13-30; PCI slots are numbered configuration links)

Selecting a link application for the new logical configuration link; (column 14, lines 5-25; The script commands are applications; column 13, lines 65-column 14, lines 5)

Selecting a sub layer interface type for the new logical configuration link; (column 14, lines 15-25; Connection identifiers are configuration links)

Creating a first endpoint for the new logical configuration link; and

Creating a second endpoint for the new logical configuration link.(column 13, lines 10-30)

As per claim 3, Hansen teaches the method of claim 2, wherein the step of selecting the link type further comprises the step of:

Selecting the link type from among a group consisting of: point-to-point, point-to-IP, and pint-to-subnet. (column 13, lines 1-10; x. 25, frame relay, PPP and HDLC)

As per claim 4, Hansen teaches the method of claim 4, wherein the step of selecting the a link number type further comprises the step of:

Selecting the link numbering type from a group consisting of: a numbered type and an un-number type. (column 11, lines 13-30; PCI slots are numbering type, column 13, lines 28-45; a list of connection interface is un-number type)

As per claim 7, Hansen teaches the method of claim 1, Hansen further teaches the step of:

Modifying a logical configuration link in the logical link databases. (column 11, lines 41-53; Editing is modifying)

As per claim 8, Hansen teaches the method of claim 1, Hansen further teaches the step of:

Deleting a logical configuration link in the logical link database. (column 10, lines 1-20)

As per claim 9, it is of the same scope as claim 1. Supra.

As per claim 10, Hansen teaches the apparatus of claim 9. Hansen teaches wherein the display device provides an ability to select a network device having at least one network

interface through the graphical user interface form. (figure 3b, column 15, lines 18-32; To configure a device, the device must be selected first)

As per claim 11, Hansen teaches the apparatus of claim 9, Hansen further teaches the processing system determines local interface and next neighbor information for the network device. (figure 7, items 114, 116, 120, 126, 122, 118, and 124)

As per claim 12, Hansen teaches the apparatus of claim 11, Hansen further teaches the processing system determines whether the local interface and next neighbor information is associated with one of the logical configuration links stored in the logical link database. (column 15, lines 30-50; Unconnected PCI slot are unassociated connection)

As per claim 13, Hansen teaches the apparatus of claim 12, Hansen further teaches creates a new logical configuration link when the local interface and next neighbor information is not associate with any of the logical configuration links stored in the logical link database. (column 13, lines 10-30)

As per claim 14, Hansen teaches the apparatus of claim 13, Hansen further teaches the processing system causes the new logical configuration link to be stored in the logical link database. (column 13, lines 10-30)

As per claim 15, Hansen teaches the apparatus of claim 14, Hansen further teaches the processing system validates the new logical configuration link. (column 13, lines 10-30)

As per claim 16, Hansen teaches the apparatus of claim 15, Hansen further teaches the processing system cause the new logical configuration link to be sent to the network device. (column 14, lines 41-60)

As per claim 17, it is rejected under the same rationale as claim 1. Supra.

As per claim 18, it is rejected under the same rationale as claim 2. Supra.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hansen in view of Hansen US Patent 5,838,907 in view of Hardwick US Patent 5,550,816.

As per claim 5, Hansen teaches the method of claim 2. Hansen fails to teach the step of selecting a link application from a group consisting of:

Internet Protocol Forwarding, Multi-Protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching.

Hardwick teaches the step of selecting a link application from a group consisting of:

Internet Protocol Forwarding, Multi-Protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching. (column 43, lines 60- column 44, lines 5)

It would have been obvious to an artisan at the time of the invention to include Hardwick's teaching with method of Hansen in order to provide a wide variety of access control tools that permit network managers to define the policy of how network group can interact within themselves.

Claims 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hansen in view of Hansen US Patent 5,838,907 in view of Chui US Patent 2002/0165978.

As per claim 6, Hansen teaches the method of claim 2, Hansen fails to teach selecting a sub layer interface type further comprises the step of :

Selecting the sub-layer interface type from a group consisting of; Packet over Sonet, Asynchronous Transfer Mode, and GigEthernet.

Chui teaches selecting a sub layer interface type further comprises the step of :

Selecting the sub-layer interface type from a group consisting of; Packet over Sonet, Asynchronous Transfer Mode, and GigEthernet. (Paragraph 0201)

It would have been obvious to an artisan at the time of the invention to include Chui's teaching with method of Hansen in order to provide a wide variety of access control tools that permit network managers to define the policy of how network group can interact within themselves.

Response to Argument

Applicant's arguments filed on 11/20/08 have been fully considered but they are not persuasive.

Applicant's argument focused on the following:

A) Hansen fails to teach "determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database."

A) Hansen system relates to both the local interface and next neighbor information by using a map editor and a configuration which are local interface (see Hansen col. 5, lines 35-45) and displaying on this interface information regarding neighboring network device. (see Hansen col. 5, lines 55-65)

B) Hansen fails to teach "creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database and storing the new logical configuration link in the logical link database."

B) Hansen teaches this limitation because the PCI slot 3, which is not connected or associated with any logical configure, can be configured to be linked to a network device and configured according to device's information. (see Hansen, column 15 ,lines 40-60) By doing so, Hansen creates a new logical configuration on the PCI slot 3 when none existed before. Furthermore, Hansen stores the newly configured script in a memory subsystem, and the memory subsystem is a database for configuration scripts. (see Hansen, column 2 ,lines 40-45) Furthermore, upon completion, the new neighbor device information is displayed on the local interface. (see Hansen, col. 17, lines 40-col. 18, line 2)

C) Hansen fails to teach "selecting a link numbering type for the new logical configuration link."

C) Hansen teaches this limitation because the new PCI is configured with desired port number and port setting. (see Hansen, col. 15, lines 5-20) The new PCI is configured with new

IP address for the specified port. (see Hansen, figure 5, items 202; col. 13, lines 45-col. 14, lines 40; the desired IP setting are set to the select port.)

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SIMON KE whose telephone number is (571)272-4062. The examiner can normally be reached on M-Th and Alternate Fridays 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen S. Hong can be reached on (571) 272-4124. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Peng Ke
/Peng Ke/
Primary Examiner, Art Unit 2174

OIPE IAP20 SEP 2 4 2009 PATENT & TRADEMARK OFFICE

PTO/SB/21 (12-08)
Approved for use through 01/31/2009. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	10/027,821
Filing Date	12-19-2001
First Named Inventor	Denis Proulx, et al.
Art Unit	2174
Examiner Name	Ke, Peng
Attorney Docket Number	1400.1374890
Total Number of Pages in This Submission	12

ENCLOSURES (Check all that apply)

- [x] Fee Transmittal Form
  - [x] Fee Attached
- [ ] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [x] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/ Incomplete Application
  - [ ] Reply to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) ____________
  - [ ] Landscape Table on CD
- [ ] After Allowance Communication to TC
- [ ] Appeal Communication to Board of Appeals and Interferences
- [x] Appeal Communication to TC (Appeal Notice, Brief, Reply Brief)
- [ ] Proprietary Information
- [ ] Status Letter
- [x] Other Enclosure(s) (please Identify below):

Pre-Appeal-Brief Request for Review
Return Receipt Post Card

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	Ross D. Snyder & Associates, Inc.		
Signature	Ross D Snyder		
Printed name	Ross D. Snyder		
Date	09-18-2009	Reg. No.	37,730

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature	Ross D Snyder		
Typed or printed name	Ross D. Snyder, Reg. No. 37,730	Date	09-18-2009

1FW AF

NOTICE OF APPEAL FROM THE EXAMINER TO THE BOARD OF PATENT APPEALS AND INTERFERENCES	Docket Number (Optional) 1400.1374890	
I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to "Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450" [37 CFR 1.8(a)] on 09-18-2009	In re Application of Denis Proulx et al.	
	Application Number 10/027,821	Filed 12-19-2001
Signature [signature]	For METHOD AND SYSTEM FOR IP LINK MANAGEMENT	
Typed or printed name Ross D. Snyder, Reg. No. 37,730	Art Unit 2174	Examiner Ke, Peng

Applicant hereby appeals to the Board of Patent Appeals and Interferences from the last decision of the examiner.

The fee for this Notice of Appeal is (37 CFR 41.20(b)(1)) $ 540.00

- ☐ Applicant claims small entity status. See 37 CFR 1.27. Therefore, the fee shown above is reduced by half, and the resulting fee is: $ ______
- ☑ A check in the amount of the fee is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The Director has already been authorized to charge fees in this application to a Deposit Account.
- ☑ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. 50-1566. I have enclosed a duplicate copy of this sheet.
- ☑ A petition for an extension of time under 37 CFR 1.136(a) (PTO/SB/22) is enclosed.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the

- ☐ applicant/inventor.
- ☐ assignee of record of the entire interest. See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96)
- ☑ attorney or agent of record. Registration number 37,730
- ☐ attorney or agent acting under 37 CFR 1.34. Registration number if acting under 37 CFR 1.34. ______

[signature]
Signature

Ross D. Snyder
Typed or printed name

512-347-9223
Telephone number

09-18-2009
Date

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☐ *Total of ______ forms are submitted.

09/25/2009 CCHAU1 00000002 10027821
01 FC:1401 540.00 OP

Doc Code: AP.PRE.REQ

PTO/SB/33 (12-08)
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PRE-APPEAL BRIEF REQUEST FOR REVIEW		Docket Number (Optional) 1400.1374890
I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to "Mail Stop AF, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450" [37 CFR 1.8(a)] on 09-18-2009 Signature [signature] Typed or printed name Ross D. Snyder, Reg. No. 37,730	Application Number 10/027,821	Filed 12-19-2001
	First Named Inventor Denis Proulx et al.	
	Art Unit 2174	Examiner Ke, Peng

Applicant requests review of the final rejection in the above-identified application. No amendments are being filed with this request.

This request is being filed with a notice of appeal.

The review is requested for the reason(s) stated on the attached sheet(s).
Note: No more than five (5) pages may be provided.

I am the

- ☐ applicant/inventor.
- ☐ assignee of record of the entire interest. See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96)
- ☑ attorney or agent of record. Registration number 37,730
- ☐ attorney or agent acting under 37 CFR 1.34. Registration number if acting under 37 CFR 1.34 ______

[signature]
Signature

Ross D. Snyder
Typed or printed name

512-347-9223
Telephone number

09-18-2009
Date

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☐ *Total of ______ forms are submitted.

PTO/SB/17 (10-08)
Approved for use through 06/30/2010. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Effective on 12/08/2004.
Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2009

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT	($) 1,650.00

Complete if Known	
Application Number	10/027,821
Filing Date	12-19-2001
First Named Inventor	Denis Proulx et al.
Examiner Name	Ke, Peng
Art Unit	2174
Attorney Docket No.	1400.1374890

METHOD OF PAYMENT (check all that apply)

☑ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): ____

☑ Deposit Account Deposit Account Number: 50-1566 Deposit Account Name: Ross D. Snyder & Assoc.

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☑ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, except for the filing fee

☑ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 ☑ Credit any overpayments

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

	FILING FEES		SEARCH FEES		EXAMINATION FEES		
Application Type	Fee ($)	Small Entity Fee ($)	Fee ($)	Small Entity Fee ($)	Fee ($)	Small Entity Fee ($)	Fees Paid ($)
Utility	330	165	540	270	220	110	
Design	220	110	100	50	140	70	
Plant	220	110	330	165	170	85	
Reissue	330	165	540	270	650	325	
Provisional	220	110	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 (including Reissues)	52	26
Each independent claim over 3 (including Reissues)	220	110
Multiple dependent claims	390	195

Total Claims ____ - 20 or HP = Extra Claims ____ x Fee ($) ____ = Fee Paid ($) ____

HP = highest number of total claims paid for, if greater than 20.

Multiple Dependent Claims: Fee ($) ____ Fee Paid ($) ____

Indep. Claims ____ - 3 or HP = Extra Claims ____ x Fee ($) ____ = Fee Paid ($) ____

HP = highest number of independent claims paid for, if greater than 3.

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $270 ($135 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets ____ - 100 = Extra Sheets ____ / 50 = Number of each additional 50 or fraction thereof ____ (round up to a whole number) x Fee ($) ____ = Fee Paid ($) ____

4. OTHER FEE(S) Fees Paid ($)

Non-English Specification, $130 fee (no small entity discount)

Other (e.g., late filing surcharge): Notice of Appeal Fee ($540.00) and Extension Fee ($1,110.00) 1,650.00

SUBMITTED BY

Signature	*Ross D. Snyder*	Registration No. (Attorney/Agent) 37,730	Telephone 512-347-9223
Name (Print/Type)	Ross D. Snyder		Date 09-18-2009

PTO/SB/22 (02-09)
Approved for use through 03/31/2009. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARMENT OF COMMERCE

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a) FY 2009 *(Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).)*	Docket Number (Optional) 1400.1374890
Application Number 10/027,821	Filed 12-19-2001
For METHOD AND SYSTEM FOR IP LINK MANAGEMENT	
Art Unit 2174	Examiner Ke, Peng

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

	Fee	Small Entity Fee	
☐ One month (37 CFR 1.17(a)(1))	$130	$65	$
☐ Two months (37 CFR 1.17(a)(2))	$490	$245	$
☑ Three months (37 CFR 1.17(a)(3))	$1110	$555	$ 1,110.00
☐ Four months (37 CFR 1.17(a)(4))	$1730	$865	$
☐ Five months (37 CFR 1.17(a)(5))	$2350	$1175	$

☐ Applicant claims small entity status. See 37 CFR 1.27.

☑ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☑ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 50-1566.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the ☐ applicant/inventor.

☐ assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) is enclosed (Form PTO/SB/96).

☑ attorney or agent of record. Registration Number 37,730

☐ attorney or agent under 37 CFR 1.34.
Registration number if acting under 37 CFR 1.34 ______

Ross D Snyder	09-18-2009
Signature	Date
Ross D. Snyder	512-347-9223
Typed or printed name	Telephone Number

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.

☐ Total of ______ forms are submitted.

09/25/2009 CCHAU1 00000002 10027821
02 FC:1253 1110.00 OP

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Denis Proulx, et al.

Title: METHOD AND SYSTEM FOR IP LINK MANAGEMENT

App. No.: 10/027,821 Filed: 12-19-2001

Examiner: Ke, Peng Group Art Unit: 2174

Atty. Dkt. No. 1400.1374890

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

PRE-APPEAL BRIEF REQUEST FOR REVIEW

Dear Sir:

Claims 1-18 are pending in the application. The Examiner has rejected claims 1-18. Appellant respectfully requests reconsideration of pending claims 1-18. Appellant files herewith a notice of appeal. Pursuant to the "New Pre-Appeal Brief Conference Pilot Program," 1296 Off. Gaz. Pat. Office 67 (July 12, 2005) and the "Extension of the Pilot Pre-Appeal Brief Conference Program" dated 1/10/2006, Appellant submits a pre-appeal brief request for review. The review is requested for the reasons set forth below:

Appellant submits there exist clear errors in the Examiner's rejections and/or the Examiner's omissions of one or more essential elements needed for a prima facie rejection. Appellant submits the Examiner's "Response to Arguments" provides evidence that the Examiner has failed to consider the pending claims as required by the Manual of Patent Examining Procedure (MPEP) and prevailing case law. For anticipation under 35 U.S.C. § 102, a reference must teach <u>every aspect</u> of the claimed invention either explicitly or implicitly. Any feature not directly taught must be inherently present [emphasis added]. See MPEP § 706.02 – distinction between 35 U.S.C. § 102 and § 103. Applicant submits MPEP § 2131 provides: "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). 'The identical invention must be shown in as complete detail as contained in the...claim.' *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). The elements must be arranged as required by the claim." MPEP § 2141 sets forth the Graham inquiries for a rejection under 35 U.S.C. § 103. MPEP § 2143 describes example of basic requirements of a *prima facie* case of obviousness under 35 U.S.C. § 103. As Applicant describes in detail below, Applicant submits there exist clear errors in the Examiner's rejections and/or the Examiner's omissions of one or more aspects of a *prima facie* rejection.

The Examiner has rejected claims 1-4 and 7-16 under 35 U.S.C. §102(b) as being anticipated by Hansen (United States Patent No. 5,838,907). Regarding claim 1, Applicant submits the cited portions of the cited reference fail to disclose the subject matter of claim 1. As an example, Applicant submits the cited portions of the cited reference fail to disclose "determining local interface and next neighbor information for the network device." The Examiner cites "(figure 7, items 114, 116, 120, 126, 122, 118, and 124)" of the Hansen reference as allegedly disclosing such feature. However, Applicant notes Figure 7 of the Hansen reference merely purports to be an illustration of a configuration manager GUI, but does not appear to disclose any method steps. As another example, Applicant submits the cited portions of the cited reference fail to disclose "determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database." While the Examiner cites "(column 5, lines 35-64; Subsystem is a logical link database)," Applicant notes the cited portion of the cited reference states, "The data and programming instruction are stored in the memory subsystem 6...," Applicant sees no teaching as to "determining whether the local interface and next neighbor information is associated with a logical configuration link stored among a plurality of logical configuration links in a logical link database." As yet another example, Applicant submits the cited portions of the cited reference fail to disclose "creating a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links in the logical link database." While the Examiner cites "(column 15, lines 30-50; Unconnected PCI slot are unassociated connection), Applicant notes col. 15, lines 33-39, state, "As may now be seen, the various network entities, as well as unconnected connection interfaces, are graphically displayed on the backplane bitmap 220 using information contained in the bitmap section 36 of the configuration script 12-N and the local configuration file 20 for the Compaq router 122." However, col. 5, lines 49-52, as the Examiner cited in alleging "Subsystem is a logical link database," states "If a particular network device does not have a configuration script, a configuration file cannot be constructed by the network device configuration tool 10." Accordingly, Applicant submits the Examiner's apparent interpretation of the teachings of the prior art would appear to render them inoperable. As yet another example, while the Examiner cites "(column 13, lines 10-30)," Applicant submits col. 13, lines 22-26, state, "If either the origination or destination device or entity do not have an available slot which is connectable to the other device or entity, a determination is made at step 156 that the devices/entities cannot be connected." Applicant submits the cited portion of the cited reference fails to disclose "storing the new logical configuration link in the logical link database." As a further example, while the Examiner cites "(column 14, lines 41-60)," Applicant notes col. 14, lines 48-50, states "...before saving the constructed local configuration file 20 to the memory subsystem and associating it with the device." Applicant submits the cited portion of the cited reference does not appear to disclose "sending the new logical configuration link to the network device."

Regarding claim 2, Applicant submits the cited portions of the cited reference fail to disclose "selecting a link type." While the Examiner cites "(column 13, lines 1-10; x.25, frame relay, PPP and HDLC are link

types," Applicant submits the Examiner has alleged, with respect to claim 1, from which claim 2 depends, that "Subsystem is a logical link database." Applicant submits the Examiner doesn't provide any evidence that "Subsystem" includes any information pertaining to "frame relay, PPP and HDLC." Thus, Applicant submits the Examiner's apparent interpretation of the teachings of the prior art would appear to render them inoperable. As another example, while the Examiner alleges "(column 11, lines 13-30; PCI slots are numbered configuration links)," Applicant submits such allegation does not disclose a step of "selecting a link numbering type...." As a further example, Applicant submits the cited portions of the cited reference fail to disclose "selecting a link application for the new logical configuration link." While the Examiner alleges "(column 14, lines 5-25; The script commands are applications; column 13, lines 65-column 14, lines 5)," Applicant notes the Examiner alleged with respect to "creating a new logical configuration link..." of claim 1, from which claim 2 depends, "Unconnected PCI slot are unassociated connection." While the Examiner alleges "The script commands are applications," Applicant sees no allegation by the Examiner that "the script commands" are disclose link applications for "unconnected PCI slot," which the Examiner appears to allege disclose "the new logical configuration link." Thus, Applicant submits the Examiner's allegations appear to be inconsistent and would render the purported teachings of the cited reference inoperable. As yet another example, while the Examiner cites "(column 14, lines 15-25; Connection identifiers are configuration links)," Applicant notes the Examiner alleged, with respect to "creating a new logical configuration link" of claim 1, from which claim 2 depends, "Unconnected PCI slot are unassociated connection." Thus, Applicant submits "connection identifiers are configuration links" is inconsistent with the purported teachings alleged by the Examiner with respect to claim 1, thereby apparently rendering such teachings inoperable. Moreover, Applicant submits "connection identifiers are configuration links" fails to disclose "selecting a sub layer interface type...." As yet another example, while the Examiner cites "(column 13, lines 10-30)," Applicant submits col. 13, lines 22-26, state, "If either the origination or destination device or entity do not have an available slot which is connectable to the other device or entity, a determination is made at step 156 that the devices/entities cannot be connected." Applicant submits the cited portion of the cited reference fails to disclose "creating a first endpoint for the new logical configuration link" and "creating a second endpoint for the new logical configuration link."

Regarding claim 7, while the Examiner cites "(column 11, lines 41-53; Editing is modifying)," Applicant notes the Examiner alleged "Unconnected PCI are unassociated connection" as purportedly teaching "creating a new logical configuration link..." in claim 1, from which claim 7 depends. Applicant sees no reference to such "unconnected PCI" in "(column 11, lines 41-53; Editing is modifying)," as alleged by the Examiner.

Regarding claim 8, while the Examiner cites "(column 10, lines 1-20)," Applicant notes the Examiner alleged "Unconnected PCI are unassociated connection" as purportedly teaching "creating a new logical configuration link..." in claim 1, from which claim 8 depends. Applicant sees no reference to such

"unconnected PCI" in "(column 10, lines 1-20)," as alleged by the Examiner. Moreover, Applicant submits teachings in "(column 10, lines 1-20)" appear to be inconsistent with "unconnected PCI." For example, "telnet to this device," "view ip addresses," and "view ipx addresses" appear to be inconsistent with "unconnected PCI," as cited by the Examiner with respect to claim 1, from which claim 8 depends.

Regarding claim 11, while the Examiner cites "(figure 7, items 114, 116, 120, 126, 122, 118, and 124), Applicant submits Figure 7 of the Hansen reference merely purports to be an illustration of a configuration manager GUI, but does not appear to disclose "wherein the processing system determines local interface and next neighbor information for the network device."

Regarding claim 12, while the Examiner cites "(column 15, lines 30-50; Unconnected PCI slot are unassociated connection)," Applicant submits the "Unconnected PCI slot are unassociated connection" alleged by the Examiner fails to disclose, for example, "next neighbor information" and "the logical link database." Thus, Applicant submits the Examiner has not made a *prima facie* showing of anticipation with respect to the subject matter of claim 12.

Regarding claim 13, while the Examiner cites "(column 13, lines 10-30)," Applicant submits col. 13, lines 22-26, state, "If either the origination or destination device or entity do not have an available slot which is connectable to the other device or entity, a determination is made at step 156 that the devices/entities cannot be connected." Applicant submits the cited portion of the cited reference fails to disclose "wherein the processing system creates a new logical configuration link when the local interface and next neighbor information is not associated with any of the logical configuration links stored in the logical link database."

Regarding claim 14, while the Examiner cites "(column 13, lines 10-30)," Applicant submits col. 13, lines 22-26, state, "If either the origination or destination device or entity do not have an available slot which is connectable to the other device or entity, a determination is made at step 156 that the devices/entities cannot be connected." Applicant submits the cited portion of the cited reference fails to disclose "wherein the processing system causes the new logical configuration link to be stored in the logical link database."

Regarding claim 16, while the Examiner cites "(column 14, lines 41-60)," Applicant notes col. 14, lines 48-50, states "...before saving the constructed local configuration file 20 to the memory subsystem and associating it with the device." Applicant submits the cited portion of the cited reference does not appear to disclose "wherein the processing system causes the new logical configuration link to be sent to the network device."

Regarding claim 18, Applicant notes the Examiner states "As per claim 18, it is rejected under the same rationale as claim 2." Applicant submits the Examiner has not alleged anticipation or cited alleged teaching

with respect to subject matter recited in claim 18, which Applicant notes is different than claim 2. Thus, Applicant submits the Examiner has not made a *prima facie* showing of anticipation with respect to claim 18.

The Examiner has rejected claim 5 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Hansen in view of Hansen (United States Patent No. 5,838,907), and further in view of Hardwick (United States Patent No. 5,550,816). Applicant notes the Examiner alleges, with respect to claim 2, from which claim 5 depends, "The script commands are applications." However, the Examiner now alleges "Hardwick teaches the step of selecting a link application from a group consisting of: Internet Protocol Forwarding, Multi-Protocol Label Switching and Internet Protocol Forwarding, and Multi-Protocol Label Switching (column 43, lines 60-column 44, lines 5)." Applicant submits the Examiner's allegations as to purported teachings of the cited references with respect to the subject matter of claims 2 and 5 are inconsistent and contradictory, thereby rendering the supposed combination of the purported teachings inoperable. Moreover, Applicant submits the Examiner's alleged motivation to combine the references does not appear to pertain to the supposed combination of the purported teachings. Thus, Applicant submits the Examiner has not made a *prima facie* showing of obviousness with respect to the subject matter of claim 5.

The Examiner has rejected claim 6 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Hansen in view of Hansen (United States Patent No. 5,838,907) in view of Chui (United States Patent No: 2002/0165978). Applicant notes the Examiner alleges, with respect to claim 2, from which claim 6 depends, "Connection identifiers are configuration links." However, the Examiner now alleges "Chui teaches selecting a sub layer interface type comprises the step of: Selecting the sub-layer interface type from a group consisting of: Packet over Sonet, Asynchronous Transfer Mode, and GigEthernet." Applicant submits the Examiner's allegations as to purported teachings of the cited references with respect to the subject matter of claims 2 and 6 are inconsistent and contradictory, thereby rendering the supposed combination of the purported teachings inoperable. Moreover, Applicant submits the Examiner's alleged motivation to combine the references does not appear to pertain to the supposed combination of the purported teachings. Thus, Applicant submits the Examiner has not made a *prima facie* showing of obviousness with respect to the subject matter of claim 6.

Respectfully submitted,

09/18/2009
Date

Ross D. Snyder

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UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/027,821	12/19/2001	Denis Proulx	1400.1374890	9507

25697 7590 10/09/2009
ROSS D. SNYDER & ASSOCIATES, INC.
PO BOX 164075
AUSTIN, TX 78716-4075

EXAMINER	
KE, PENG	

ART UNIT	PAPER NUMBER
2174	

MAIL DATE	DELIVERY MODE
10/09/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

PTOL-90A (Rev. 04/07)

Application Number	Application/Control No.	Applicant(s)/Patent under Reexamination	
	10/027,821	PROULX ET AL.	
	Simon Ke	Art Unit 2174	

Document Code - AP.PRE.DEC

Notice of Panel Decision from Pre-Appeal Brief Review

This is in response to the Pre-Appeal Brief Request for Review filed Sept. 24, 2009.

1. ☐ **Improper Request** – The Request is improper and a conference will not be held for the following reason(s):

   ☐ The Notice of Appeal has not been filed concurrent with the Pre-Appeal Brief Request.
   ☐ The request does not include reasons why a review is appropriate.
   ☐ A proposed amendment is included with the Pre-Appeal Brief request.
   ☐ Other: .

   The time period for filing a response continues to run from the receipt date of the Notice of Appeal or from the mail date of the last Office communication, if no Notice of Appeal has been received.

2. ☒ **Proceed to Board of Patent Appeals and Interferences** – A Pre-Appeal Brief conference has been held. The application remains under appeal because there is at least one actual issue for appeal. Applicant is required to submit an appeal brief in accordance with 37 CFR 41.37. The time period for filing an appeal brief will be reset to be one month from mailing this decision, or the balance of the two-month time period running from the receipt of the notice of appeal, whichever is greater. Further, the time period for filing of the appeal brief is extendible under 37 CFR 1.136 based upon the mail date of this decision or the receipt date of the notice of appeal, as applicable.

   ☒ The panel has determined the status of the claim(s) is as follows:
   Claim(s) allowed: _____.
   Claim(s) objected to: _____.
   Claim(s) rejected: *1-18*.
   Claim(s) withdrawn from consideration: _____.

3. ☐ **Allowable application** – A conference has been held. The rejection is withdrawn and a Notice of Allowance will be mailed. Prosecution on the merits remains closed. No further action is required by applicant at this time.

4. ☐ **Reopen Prosecution** – A conference has been held. The rejection is withdrawn and a new Office action will be mailed. No further action is required by applicant at this time.

All participants:

(1) *Simon Ke*. (3) */Eddie C. Lee/*.

(2) *Dennis Chow*. (4) _____.

ASSIGNMENT OF U.S. PATENT APPLICATION

This is an assignment of patent rights between the inventor(s)

Denis Proulx	**Chuong Ngoc Ngo**
Attaullah Zabihi	**David Wing-Chung Chan**
Felix Katz	

(herein after referred to as the Inventor) and **ALCATEL CANADA INC.** having a place of business at 600 March Road, Kanata, Ontario, Canada K2K 2E6 (herein after referred to as the Assignee).

WHEREAS, Inventor has caused to be prepared on December 19, 2001, a United States Patent Application Number 10/027,821 in the Inventor's name entitled

METHOD AND SYSTEM FOR IP LINK MANAGEMENT

having a docket number of **1400.1374890** (herein after referred to as the Patented Invention); and

WHEREAS, Assignee has a desire to acquire all rights, title, and interest in the Patented Invention.

NOW, THEREFORE, the parties agree as follows:

1. The Inventor hereby sells, assigns, and transfers its entire rights, title, and interest in the Patented Invention and all patents that may be granted therefrom due to divisions, reissue, substitutions, extensions, continuations, and continuations-in-part to the Assignee.

2. The Inventor hereby sells, assigns, and transfers its entire rights, title, and interest in any foreign (non U.S.) national patent application, invention registration, or equivalent (Foreign Applications), claiming approximately the same subject matter of the Patented Invention to the Assignee.

3. In consideration for the sum of one dollar ($1) U.S. (or its equivalent) and other consideration for which both parties acknowledge to be valuable, having been conveyed to the Inventor by the Assignee for the sale, assignment, and transfer of the Patented Invention and Foreign Applications. Consideration may include at least one of: employment, an independent contractor agreement, monetary payment, or other benefit hereby acknowledged as received.

4. Inventor hereby authorizes and requests the Commissioner of Patents and Trademarks to issue the patent for the Patented Invention, and all resulting patents therefrom, insofar as Inventor's interest is concerned, to the Assignee.

5. The Inventor further agrees to execute any and all powers of attorney, applications, assignments, declarations, affidavits, and any other papers in connection therewith necessary to perfect such rights, title, and interest in the Assignee.

6. The Inventor hereby further agrees to communicate with the Assignee any facts its knows regarding any improvements of the Patented Invention while employed by Assignee and for one year thereafter.

7. The Inventor hereby yet further agrees to, at the expense of the Assignee:
   i) testify in any legal proceedings,
   ii) sign all lawful papers,
   iii) execute all divisional, continuation, continuation-in-part, reissue and substitute applications,
   iv) make all lawful oaths, and assist in vesting title in the Assignee and to aid the Assignee to obtain and enforce proper protection for the subject matter of the Patented Invention in all countries, and
   v) notify Assignee promptly (by facsimile or first class mail) of any subpoena or contact by any person other than Assignee or its agents regarding the Application or resultant patent(s) issuing therefrom, and in any event at least one week prior to any deposition, legal inquiry or legal proceeding relating to the above identified invention.

This assignment is executed on the date(s) of which the Inventor has signed.

Inventor:

Denis Proulx	Date: Feb/27/2002
Chuong Ngoc Ngo	Date: Feb 27, 2002
Attaullah Zabihi	Date: 2002/02/27
David Wing-Chung Chan	Date: 28 Feb 2002
Felix Katz	Date: 28 Feb 2002

STATEMENT OF WITNESS

I, Maxine Raycroft, whose full post office address is 7 Scheel Drive, Arnprior Ont K7S3G8, state that I was personally present and did see **Denis Proulx**, who is personally known to me to be the person named in the above assignment, duly sign and execute the same on the date set forth above.

Maxine Raycroft
(Signature of Witness)

STATEMENT OF WITNESS

I, Maxine Raycroft, whose full post office address is 7 Scheel DR. Arnprior Ont K7S3G8, state that I was personally present and did see **Chuong Ngoc Ngo**, who is personally known to me to be the person named in the above assignment, duly sign and execute the same on the date set forth above.

Maxine Raycroft
(Signature of Witness)

STATEMENT OF WITNESS

I, Maxine Raycroft, whose full post office address is 7 Scheel Dr. Arnprior Ont K7S3G8, state that I was personally present and did see **Attaullah Zabihi**, who is personally known to me to be the person named in the above assignment, duly sign and execute the same on the date set forth above.

Maxine Raycroft
(Signature of Witness)

STATEMENT OF WITNESS

I, Maxine Raycroft, whose full post office address is 7 Scheel DR. Arnprior Ont K7S3G8, state that I was personally present and did see **David Wing-Chung Chan**, who is personally known to me to be the person named in the above assignment, duly sign and execute the same on the date set forth above.

Maxine Raycroft
(Signature of Witness)

STATEMENT OF WITNESS

I, Maxine Raycroft, whose full post office address is 7 Scheel Drive, Arnprior Ont K7S3G8, state that I was personally present and did see **Felix Katz**, who is personally known to me to be the person named in the above assignment, duly sign and execute the same on the date set forth above.

Maxine Raycroft
(Signature of Witness)

Industry Canada | Industrie Canada

Corporations Canada
9th floor
Jean Edmonds Towers South
365 Laurier Avenue West
Ottawa, Ontario K1A 0C8

Corporations Canada
9e étage
Tour Jean Edmonds sud
365, avenue Laurier ouest
Ottawa (Ontario) K1A 0C8

December 22, 2006 / le 22 décembre 2006

Your file - Votre référence

Our file - Notre référence
439516-6

KIM COE-TURNER
ALCATEL NETWORKS CORPORATION
600 MARCH
KANATA ONTARIO
K2K 2E6

Re - Objet
Alcatel-Lucent Canada Inc.

Enclosed herewith is the document issued in the above matter.

A notice of issuance of CBCA documents will be published in the *Canada Corporations Bulletin* . A notice of issuance of CCA documents will be published in the *Canada Corporations Bulletin* and the *Canada Gazette*.

IF A NAME OR CHANGE OF NAME IS INVOLVED, THE FOLLOWING CAUTION SHOULD BE OBSERVED:

This name is available for use as a corporate name subject to and conditional upon the applicants assuming full responsibility for any risk of confusion with existing business names and trade marks (including those set out in the relevant NUANS search report(s)). Acceptance of such responsibility will comprise an obligation to change the name to a dissimilar one in the event that representations are made and established that confusion is likely to occur. The use of any name granted is subject to the laws of the jurisdiction where the company carries on business.

Vous trouverez ci-inclus le document émis dans l'affaire précitée.

Un avis de l'émission de documents en vertu de la LCSA sera publié dans le *Bulletin des sociétés canadiennes* . Un avis de l'émission de documents en vertu de la LCC sera publié dans le *Bulletin des sociétés canadiennes* et dans la *Gazette du Canada* .

S'IL EST QUESTION D'UNE DÉNOMINATION SOCIALE OU D'UN CHANGEMENT DE DÉNOMINATION SOCIALE, L'AVERTISSEMENT SUIVANT DOIT ÊTRE RESPECTÉ :

Cette dénomination sociale est disponible en autant que les requérants assument toute responsabilité de risque de confusion avec toutes dénominations commerciales et toutes marques de commerce existantes (y compris celles qui sont citées dans le(s) rapport(s) de recherches de NUANS pertinent(s)). Cette acceptation de responsabilité comprend l'obligation de changer la dénomination de la société en une dénomination différente advenant le cas où des représentations sont faites établissant qu'il y a une probabilité de confusion. L'utilisation de tout nom octroyé est sujette à toute loi de la juridiction où la société exploite son entreprise.

Myra Fortin

For the Director General, Corporations Canada | pour le Directeur général, Corporations Canada

Canada

Industry Canada | Industrie Canada

Certificate of Amalgamation

Canada Business Corporations Act

Certificat de fusion

Loi canadienne sur les sociétés par actions

Alcatel-Lucent Canada Inc.	**439516-6**
Name of corporation-Dénomination de la société	Corporation number-Numéro de la société

I hereby certify that the above-named corporation resulted from an amalgamation, under section 185 of the *Canada Business Corporations Act*, of the corporations set out in the attached articles of amalgamation.

Je certifie que la société susmentionnée est issue d'une fusion, en vertu de l'article 185 de la *Loi canadienne sur les sociétés par actions*, des sociétés dont les dénominations apparaissent dans les statuts de fusion ci-joints.

Richard G. Shaw
Director - Directeur

January 1, 2007 / le 1 janvier 2007
Date of Amalgamation - Date de fusion

Canada

Industry Canada — Industrie Canada

Canada Business Corporations Act — Loi canadienne sur les sociétés par actions

FORM 9
ARTICLES OF AMALGAMATION
(SECTION 185)

FORMULAIRE 9
STATUTS DE FUSION
(ARTICLE 185)

1 – Name of the Amalgamated Corporation — Dénomination sociale de la société issue de la fusion

Alcatel-Lucent Canada Inc.

2 – The province or territory in Canada where the registered office is to be situated — La province ou le territoire au Canada où se situera le siège social

Ontario

3 – The classes and any maximum number of shares that the corporation is authorized to issue — Catégories et tout nombre maximal d'actions que la société est autorisée à émettre

See Annexed "Schedule A" which is incorporated in this form

4 – Restrictions, if any, on share transfers — Restrictions sur le transfert des actions, s'il y a lieu

None

5 – Number (or minimum and maximum number) of directors — Nombre (ou nombre minimal et maximal) d'administrateurs

Minimun 1 - Maximum 15

6 – Restrictions, if any, on business the corporation may carry on — Limites imposées à l'activité commerciale de la société, s'il y a lieu

None

7 – Other provisions, if any — Autres dispositions, s'il y a lieu

See Annexed Schedule "B" which is incorporated in this form

8 – The amalgamation has been approved pursuant to that section or subsection of the Act which is indicated as follows: — La fusion a été approuvée en accord avec l'article ou le paragraphe de la Loi indiqué ci-après

- [x] 183
- [ ] 184(1)
- [ ] 184(2)

9 – Name of the amalgamating corporations / Dénomination sociale des sociétés fusionnantes	Corporation No. / N° de la société	Signature	Date	Title / Titre	Tel. No. / N° de tél.
Alcatel Canada Inc.	421184-7	[signature]	2007-01-01	Director	613 784-6310
Lucent Technologies Canada					
Corp./Technologies Lucent	667402-0				
Canada Corp.		[signature]	2007-01-01	Director	905-943-5000

FOR DEPARTMENTAL USE ONLY – À L'USAGE DU MINISTÈRE SEULEMENT

439516-6

R 19 DEC '06 14:06

IC 3190 (2004/12)

Canada

Canada Business Corporations Act

Articles of Amalgamation
FORM 9
INSTRUCTIONS

General
If you require more information in order to complete Form 9, you may wish to consult the Name Granting Compendium or the Name Granting Guidelines and the Amalgamation Kit.

You must file Form 9 by sending or faxing the completed documents to the address provided below.

Prescribed Fees
By mail or fax: $200

Item 1
Set out the proposed name for the amalgamated corporation that complies with sections 10 and 12 of the Act. If this name is not the same as one of the amalgamating corporations, articles of amalgamation must be accompanied by a Canada-biased NUANS search report dated not more than ninety (90) days prior to the receipt of the articles by the Director. On request, a number name may be assigned under subsection 11(2) of the Act, without a search.

Item 2
Set out the name of the province or territory within Canada where the registered office is to be situated.

Item 3
Set out the details required by paragraph 6(1)(c) of the Act, including details of the rights, privileges, restrictions and conditions attached to each class or series of shares. All shares must be without nominal or par value and must comply with the provisions of Part V of the Act.

Item 4
If restrictions are to be placed on the right to transfer shares of the corporation, set out a statement to this effect and the nature of such restrictions.

Item 5
Set out the number of directors. If cumulative voting is permitted, the number of directors must be invariable; otherwise it is permissible to specify a minimum and maximum number of directors.

Item 6
If restrictions are to be placed on the business the corporation may carry on, set out the restrictions.

Item 7
Set out any provisions, permitted by the Act or Regulations to be set out in the by-laws of the corporation, that are to form part of the articles, including any pre-emptive rights or cumulative voting provisions.

Item 8
Indicate whether the amalgamation is under section 183 or subsection 184(1) or (2) of the Act.

Other Notices and Documents
(1) The Articles must be accompanied by Form 2 *'Information Regarding the Registered Office and the Board of Directors'* and a statutory declaration of a director or authorized officer of each amalgamating corporation in accordance with subsection 185(2) of the Act.
(2) All amalgamating corporations should ensure that all filing requirements contained in the Act have been met.

The completed document and fees payable to the Receiver General for Canada are to be sent to:

The Director, Canada Business Corporations Act
Jean Edmonds Tower, South
9th Floor
365 Laurier Ave. West
Ottawa, Ontario
K1A 0C8
or by facsimile at: (613) 941-0999
Inquiries: 1-866-333-5556

Loi canadienne sur les sociétés par actions

Statuts de fusion
FORMULAIRE 9
INSTRUCTIONS

Généralités
Si vous désirez obtenir de plus amples informations afin de compléter le formulaire 9, veuillez consulter l'Énoncé d'octroi des dénominations ou les lignes directrices pour l'octroi des dénominations ainsi que le Recueil d'information sur les fusions.

Vous devez déposer le formulaire 9 en envoyant ou en télécopiant le document complété à l'adresse indiquée au bas de cette page.

Droits payables
Par la poste ou télécopieur : 200 $

Rubrique 1
Indiquer la dénomination sociale de la société issue de la fusion, laquelle doit satisfaire aux exigences des articles 10 et 12 de la Loi. Si cette dénomination diffère de celle de l'une des sociétés fusionnantes, les statuts de fusion doivent être accompagnés d'un rapport de recherche NUANS couvrant le Canada, dont la date remonte à quatre-vingt-dix (90) jours ou moins avant la date de réception des statuts par le directeur. Si un numéro matricule est demandé en guise de dénomination sociale, il peut être assigné, sans recherche préalable, en vertu du paragraphe 11(2) de la Loi.

Rubrique 2
Indiquer le nom de la province ou du territoire au Canada où le siège social se situera.

Rubrique 3
Indiquer les détails requis par l'alinéa 6(1)c) de la Loi, y compris les détails des droits, privilèges, restrictions et conditions assortis à chaque catégorie ou série d'actions. Toutes les actions doivent être sans valeur nominale ou sans valeur au pair et doivent être conformes aux dispositions de la partie V de la Loi.

Rubrique 4
Si le droit de transfert des actions de la société doit être restreint, inclure une déclaration à cet effet et indiquer la nature de ces restrictions.

Rubrique 5
Indiquer le nombre d'administrateurs. Si un vote cumulatif est prévu, ce nombre doit être fixe; autrement, il est permis de spécifier un nombre minimal et maximal d'administrateurs.

Rubrique 6
Si des limites doivent être imposées à l'activité commerciale de la société, les indiquer.

Rubrique 7
Indiquer les dispositions que la Loi ou le règlement permet d'énoncer dans les règlements administratifs de la société et qui doivent faire partie des statuts, y compris les dispositions relatives au vote cumulatif ou aux droits de préemption.

Rubrique 8
Indiquer si la fusion est faite en vertu de l'article 183 ou du paragraphe 184(1) ou (2) de la Loi.

Autres avis et documents
(1) Les status doivent être accompagnés du formulaire 2 *'Information concernant le siège social et le conseil d'administration'* et d'une déclaration solennelle d'un administrateur ou d'un dirigeant autorisé de chaque société fusionnante conformément au paragraphe 185(2) de la Loi.
(2) Les sociétés fusionnantes doivent s'assurer que toutes les exigences de dépôt contenues dans la Loi ont été remplies.

Le document complété et les droits payables au Receveur général du Canada doivent être envoyés au :

Directeur, Loi canadienne sur les sociétés par actions
Tour Jean Edmonds, sud
9ième étage
365, av. Laurier ouest
Ottawa (Ontario)
K1A 0C8
ou par télécopieur : (613) 941-0999
Renseignements : 1-866-333-5556

SCHEDULE "A"

3. The classes and any maximum number of shares that the corporation is authorized to issue:

COMMON SHARES

(a) an unlimited number of Common Shares without nominal or par value (the "**Common Shares**"), the holders of which are entitled:

(i) to one vote per share at all meetings of shareholders, except meetings at which only holders of a specified class of shares are entitled to vote;

(ii) subject to the rights, privileges, restrictions and conditions attaching to any other class or series of shares of the Corporation, to receive any dividends declared and payable by the Corporation on the Common Shares;

(iii) subject to the rights, privileges, restrictions and conditions attaching to any other class or series of shares of the4 Corporation, to receive the remaining property of the Corporation upon a liquidation, dissolution or winding-up of the Corporation;

and the holder of a fractional Common Share is entitled to exercise voting rights and to receive dividends in respect thereof.

SCHEDULE "B"

(a) Without in any way limiting the borrowing powers of the directors under the Canada Business Corporations Act, as amended from time to time, the Board of Directors may from time to time, in such amounts and on such terms as it deems expedient:

(i) borrow money on the credit of the Corporation;

(ii) limit or increase the amount to be borrowed;

(iii) issue debentures or other securities of the Corporation;

(iv) pledge or sell such debentures or other securities for such sums and at such prices as may be deemed expedient;

(v) secure any such debentures, or other securities, or any other present or future borrowing or liability of the Corporation, by mortgage, hypothec, charge or pledge of all or any currently owned or subsequently acquired real and personal, moveable and immoveable, property of the Corporation, and the undertaking and rights of the Corporation.

Nothing in this paragraph limits or restricts the borrowing of money by the Corporation on bills of exchange or promissory notes made, drawn, accepted or endorsed by or on behalf of the Corporation.

The Board of Directors may from time to time delegate to such one or more of the directors and officers of the Corporation or persons as may be designated by the Board all or any of the powers conferred on the Board above to such extent and in such manner as the Board shall determine at the time of such delegation.

For greater certainty the foregoing powers conferred on the directors shall be deemed to include the powers conferred on a company by Division VII of the Special Corporate Powers Act, being Chapter P-16 of the Revised Statutes of Quebec, 1977 and every statutory provision that may be substituted therefor or for any provision therein.

(b) The directors may from time to time appoint one or more directors in accordance with the laws governing the Corporation.

Application No: 10/027,821

OTHER EVIDENCE FILED AFTER THE NOTICE OF APPEAL

RELATED CASES SECTION

As stated above, as presently advised, there are no other prior or pending appeals, interferences, or judicial proceedings known to Appellant, the Appellant's legal representative, or Assignee which may be related to, directly affect, or be directly affected by, or have a bearing on the Board's decision in the pending appeal. Thus, no copies of decisions rendered by a court or by the Board are provided.

Respectfully submitted,

04/26/2010
Date

Ross D. Snyder, Reg. No. 37,730
Attorney for Appellant(s)
Ross D. Snyder & Associates, Inc.
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Austin, Texas 78716-4075
(512) 347-9223 (phone)
(512) 347-9224 (fax)